ARCHIVES OF OPHTHALMOLOGY.

OBSERVATIONS ON THE TOPICAL DIAGNOSTIC AND PSYCHIATRICAL VALUE OF THE WILBRAND TEST WITH A NEW CLINICAL INSTRUMENT.[1]

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(With two cuts in text and two figures on Text-Plate II.)

FOR ten years following the original suggestion of the topical diagnostic possibilities of the hemianoptic prism phenomena by Wilbrand in 1899, little interest was taken in the question, as is evidenced by the lack of communications on the subject until that of Behr in 1909. Apparently it was the investigations of Hess, in 1907, on the allied subject of the hemiopic pupillary reaction which stimulated interest, for the two subjects have since that time usually been considered together.[2]

Wilbrand (12), in 1899, having become convinced that the Wernicke hemiopic pupillary reaction was a practical failure, decided that a new method to the same end was desirable,

[1] From the surgical clinic of Prof. Harvey Cushing at the Peter Bent Brigham Hospital, Harvard Medical School.

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[2] Thus both subjects were considered in our communication (9) of 1913. But this year the data and instruments have become too bulky for a single communication. The instrument here presented could not be satisfactorily transported and was reserved for this session. The new instrument for testing the hemiopic pupillary reaction has already been presented elsewhere (10).

and proposed his hemianoptic prism phenomenon. With one eye covered, the hemianoptic patient was told to concentrate attention on a small white point on a black wall. A strong prism was then suddenly placed before the eye, throwing the image on the blind retina. If the eye instantly moved so as to fix on the point again, the lesion was central; otherwise it was peripheral to the basal stem ganglion. Likewise if the prism was suddenly interposed, throwing the image on the seeing retina, the eye instantly moved to fix the image again; but when the prism was suddenly removed the eye would once more jerk back to fix the point or not according as the lesion was central or peripheral. While he found positive or central cases verified at necropsy, he found no negative or peripheral cases. One case of acromegalic bitemporal hemianopsia failed to give the negative test, presumably, he thought, because there was some light perception left in the defective field. The test may be made binocularly in homonymous cases. Wilbrand himself did not argue the presence of a definite reflex arc in this phenomenon, but subsequent observers have postulated such an arc; for instance, Behr locates the afferent branch in Bernheimer's fibers, which are supposed to have about the same course as the pupillomotoric fibers.

In the latter part of 1906, Bielschowsky (4) reported a single case, that of an intelligent young girl with temporal hemianopsia in one eye and blindness in the other eye from a chiasmal lesion. Refixation was equally prompt on each side with 40° prisms.

Behr (1), in 1909, reported the Wilbrand test on twenty cases of hemianopsia, by the prism method, and found no reason to doubt the diagnostic value of the test. In the same year, Lenz (8), in an exhaustive study of the cerebral visual paths, reviewed the work of Behr, but ventured no opinion in the absence of sufficient pathological material.

In 1910, Krusius (7) examined four cases by the prism method and reached the conclusion that the test was of doubtful value. A little later in the same year, Köllner reported the Wilbrand test in nine cases of homonymous hemianopsia, all presumably of central origin. Binocular prisms of 15° to 30° were used. The considerable delay shown by these patients in refixing the object on the blind side led him to doubt

the diagnostic value of the reaction. Jess (5), in 1912, arrived at the same conclusion from a study of three cases.

In my own study (10) of twelve cases, reported in 1913, I came to the conclusion that several important factors had not previously been sufficiently well controlled. When prisms are used, unless they are placed before the eye very quickly and carefully, the patient may note a slight movement of the test object, indicating in which direction the object has apparently been deflected. The position of the thick or thin edge of the prism may be associated by an intelligent patient with a certain position of the test object. But worse than this, the test object always returned to the center when the prism was removed, and had always been placed so as to refract in the horizontal plane, so that intelligent observation on the part of the patient could materially aid him on repeated trials. And queerly enough the crucial experiment had never been recorded of using a disappearing object and noting the action of the eyes when the object was simply lost from view and no stimulus was active in the blind field. This latter test threw considerable light on the intelligence of the patient as a complicating factor. To control all of these possible complications, from one to three small electrically lighted spots were used. These were invisible to the patient and could be moved into various planes and distances from the center. All could be turned on or off at will in any sequence. Although this method required the use of an assistant to move the lights into different positions—for the patient was to be entirely denied advance information as to where the lights would next appear—nevertheless very consistent results were obtained, and all for the most part cast great doubt on the diagnostic value of the Wilbrand test. However, it seemed possible that if the reaction times were carefully studied in a large number of cases with an elaborate apparatus meeting all the requirements, certain characteristics of the reaction could perhaps be found which would be of practical, or at least scientific, value. The apparatus previously used was somewhat difficult and time-consuming to manipulate and could be improved in certain features. Accordingly a new instrument was designed and built, with which a large number of patients could be easily and quickly examined.

THE NEW INSTRUMENT

In order to obtain displacements of the test lights up to 45° from the center and not vary this distance from the patient, a large awning or canopy umbrella, five feet in diameter when extended and built on a radius of one meter, was selected. This was painted black and mounted upon an adjustable stand. In order to present a smooth concave inner surface to the patient the center pole and bracing were removed and the umbrella was held open in a vertical position, as shown in the cut, Fig. 1, by guy wires running from each rib behind to a corresponding steel spoke extending from a forged central hub attached to the top of the adjustable stand. These spokes in addition support a board 12 inches wide by 14 inches long, which forms a central station for the wiring system. To this board are also attached a tin box containing three dry cells, a resistance coil, and an automatic magnet short switch. The latter is packed in a heavy felt covering to muffle any slight click that it may make.

From the central station a piece of rubber gas tubing 10 feet long, containing twenty-four wires for the necessary connections, runs to the portable switchboard, which has a simple push button key for each light and a resistance coil or rheostat for regulating the intensity of the lights. The central switch on the switchboard for controlling the central light on the umbrella is arranged differently than are the switches for the other lights. When it is released it springs upward and meets a contact point, lighting the central light directly until any other switch is closed, when its corresponding lamp will light and the central light in the same instant be automatically turned out. If the central switch is pushed down away from the upper contact the central light goes out. If now it is pushed still farther down, until it strikes the lower contact point, the central lamp is again lighted in the same way that the other switches light their respective lamps.

The wiring necessary to accomplish this control is schematically shown in Fig. 2. One side of each of the 19 lamps is connected to one side of the battery (B) after passing through the rheostat (R). The other side of each lamp is connected by respective wires to the contact point of its respective switch,

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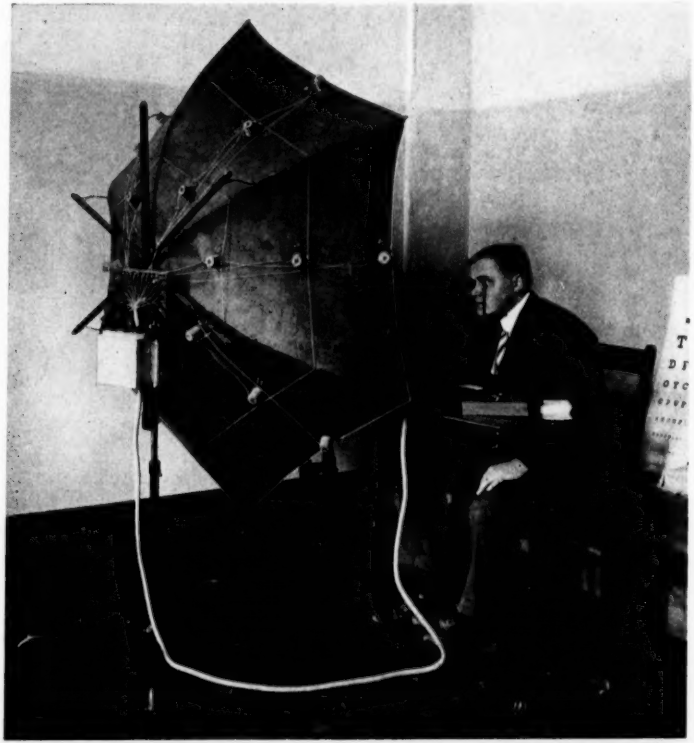

FIG. 1. Photograph showing general arrangement of patient in position to be examined with the new instrument. Apparatus is slightly turned to give better view.

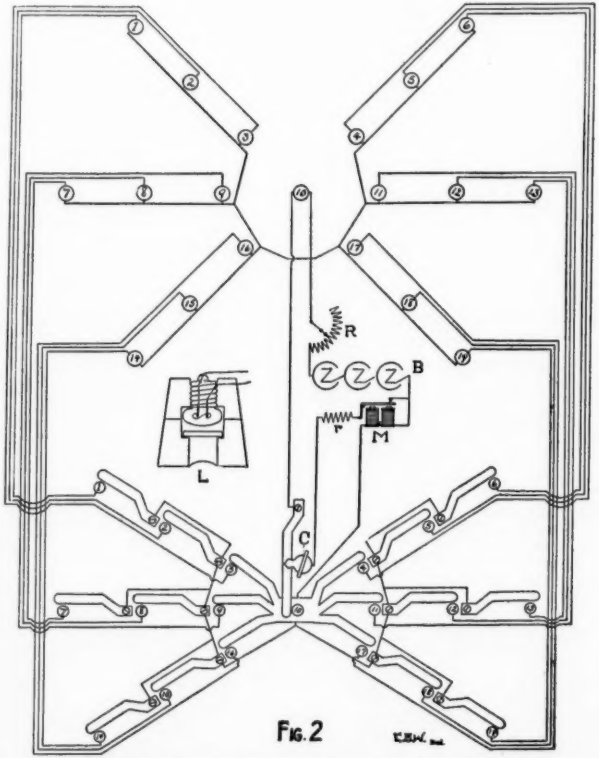

FIG. 2. Schematic diagram of arrangement and electrical connections in the new apparatus, (R) rheostat switchboard controlling intensity of lights; (B) battery; (C) movable contact-point; (r) resistance, equal to resistance of (M) magnets; (L) diagram of light container and mounting.

with the exception of the central light, which is connected to the opposite side of the central switch. The opposite sides of the remaining switches are connected together and to the magnet (M) and thence to the other side of the battery (B). The central switch may light the central lamp through two contacts. One contact (C), above, is connected through the resistance (r) and the armature of the magnets (M) to the battery (B), as shown in the cut. The resistance (r) is equal to that of the magnets (M), so that the light intensity is the same in either circuit. The contact (C) may be rotated to one side if its use is not required. The other contact (No. 10), below, lights the central lamp through the magnets as do the other switches.

The operation of the lights by this arrangement is obviously simple. In the position shown in the cut, the central lamp only will be lighted, the current passing from the battery through the armature of the magnets and the resistance (r) through the contact (C) and the central switch to the central light and back to the battery through the rheostat (R). If now any other switch is closed the current shunts through the magnet (M), which draws down the armature, breaking the circuit of the central light, and at the same instant the whole current passes through the magnet around through the wires and lamp corresponding to the switch closed. If the switch is released the central lamp will again light as the magnet allows its armature to spring up to its contact point. If it is desired to turn out the central light momentarily the central switch is simply depressed until contact with (C) is broken. Further pressure will relight the central lamp as the switch touches contact point No. 10. If any other lamp is burning and it is desired to turn it out without lighting the central lamp, either the contact (C) may be rotated to one side or the central switch may be pressed down, out of contact, and the switch corresponding to the lighted lamp released. But if we do not wish the center to be relighted each time but wish to change the light to various parts of the field, the contact (C) is turned to one side and each switch lighting a lamp is released as the next one is depressed. In this way displacements up to 90° may readily be obtained.

The lights controlled in this manner are arranged on the

umbrella in the horizontal line and in the two lines at 45° with the horizontal passing through the center. There are three lights distributed along each line from the center, so that displacements of 15°, 30°, and 45° may be obtained in each direction from the center when the patient is seated one meter from center. The lamps (2½ volt, tungsten) are set in a large cork, as shown in (L) of Fig. 2. The cork was first cut perpendicular to its axis through the central point. Each half was then bored from each end with different-sized cork borers until a cross-section, such as is seen in the cut, was obtained. The lamp, with wire connections soldered on, was then screwed into the upper segment and a disk of milk glass fitted into the lower segment, as indicated in the drawing. Each lower segment was then glued in place on the back of the umbrella and a hole burned through the cloth with a red-hot iron rod corresponding to the hole in the cork, at the same time blackening the inside of the cork. The milk glass disk was then placed in position and the upper segment containing the lamp was glued in place over the lower segment. The purpose of having the light surface thus set at the bottom of a black tube about 1*cm* in depth is to render it entirely invisible to the patient in semi-darkness, except when illuminated.

For convenience in manipulating the lights the switchboard was made about the same size as a field chart and the keys were arranged in the same relative position and order as the lights on the umbrella. In this way the keyboard may be operated with one hand entirely by touch, and undivided attention may be given to observing the timing the movements of the patient's eyes.

METHOD OF EXAMINATION.

Since we are studying a reaction which is supposed to have characteristics of a more or less involuntary or subconscious nature, it is obviously necessary to eliminate as far as possible thoughtful and voluntary processes. To get the particular mental repose which would be ideal for these examinations is very difficult, if not impossible. It is not desirable to instruct the patient as to the method and rationale of the examination, and yet this very ignorance of the procedure

has often been noted to make the patient fidgety and querulous in regard to what is taking place, at a great expense to his

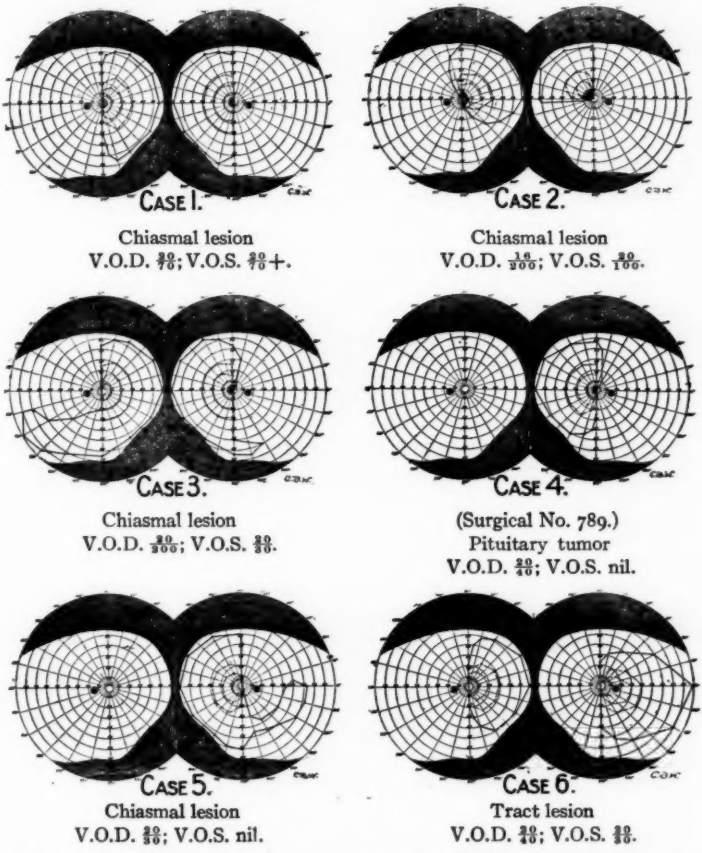

FIG. 3. Typical fields of anterior cases examined. The history and examination for Case 1 is given in the text, but for the other cases only in the *Transactions*.

mental repose. Difficulties of the following sort arise. The patient has had several fields taken and possibly other examinations requiring rigid central fixation, no matter what takes place in the peripheral field. Now we do not wish the patient

to stare willfully in one direction in this examination, nor do we wish to suggest that the field be deliberately searched for the test object in case it should disappear. The examination should not be attempted on the same day that a field or other test requiring central fixation has been made, and preferably should be made in another room, to dissociate as much as possible from the idea of perimetry. But even at best the patient, if intelligent, rapidly becomes familiar with the procedure as it is repeated, markedly reducing the refixation time, and finally as facility increases may become interested and amused at the "hide-and-seek" element of the examination. Thus it becomes necessary to conduct the examination in two stages. In the first stage the patient is given as little instruction as possible and is quietly seated before the instrument, without unnecessary distractions of any kind. He is simply told to observe the light wherever it may be. The automatic return to the central light is used only at intervals, since there is a marked tendency on the part of the patient to look back to the center if it is used continuously. At the end of the first stage (five to ten trials) he usually begins to show a greater or less decrease in reaction time, or if he is not very intelligent further instructions are necessary to gain a better state of mental repose.

In performing the tests the patient is seated at a distance of one meter from the center of the apparatus. While a chin-rest is not necessary, it reduces the tendency to turn the head with the eyes, thereby making observations of ocular movements easier. There should be dim room illumination, just sufficient to show clearly the movement of the patient's eyes. This illumination is from a rheostat ceiling light just out of the patient's peripheral field of vision above. Observation of ocular movements may be made with a short focus telescope or by the unaided eye. No difficulties are presented either way. The intensity of the test lights is regulated by the rheostat to the point where no sense of dispersion light is obtained when its image is made to fall on the normal blind spot. Such an intensity of illumination, while greater than that of a white spot on a black wall, still offers no indication by dispersion sheen to the hemianoptic patient of its location when it is in the blind field. In case there is a relative central scotoma

the examination can usually still be made if there is vision in the neighborhood of $\frac{20}{200}$, by increasing the light intensity somewhat, since with macular damage the sensitiveness to dispersion light is not so acute.

For rapid and accurate manipulation of the lights with respect to the field of vision a copy of the field may be held close at hand, or the field outline may be lightly chalked on the black top switchboard for each eye, so that one may simply press a key in a certain part of this charted field and a light will appear in the corresponding field of vision of the patient. When the reaction runs over a second it should be timed with a stop-watch. If the reaction time is less than a second, a system of counting, carefully practised, is more satisfactory.

In taking the end point of the reaction time it has been found much better to watch the eye come to rest rather than to ask the patient to say some such word as "Now" when the light is located, because the patient seems to feel more under strain of examination with this added requirement and is apt to put much more willful effort into locating the spot, immediately showing an exaggeration of the tendency to seeking movements.

Prisms have not been used, for several reasons: (1) The patient may get an inkling as to which way the image is going to be refracted as it travels the edge of the prism, or (2) by associating the thick edge of the prism with a certain position of the image. (3) He may see certain portions of the room through the prism which form orientation marks as to the position of the light. (4) If the prism is held close to the eye, the refraction prevents accurate observation of the eye movements. (5) If the prism is held forward far enough to observe the eye directly, the patient may get either orienting or disorienting glimpses of the room around the prism margin.

Previous experience with these tests having shown that the reaction time decreased after the first few trials, or as soon as the patient became familiar with the general procedure, it became necessary to proceed with the simpler tests first and with these confined to the blind side, for if the light is first changed from the center to the seeing side, and then disappears in the center to appear on the blind side, the natural conclusion is that it must be in that side since it is not in the seeing field.

Therefore the 15°, and then the 30° and then the 45° displacement horizontally is tried on the blind side. The center light

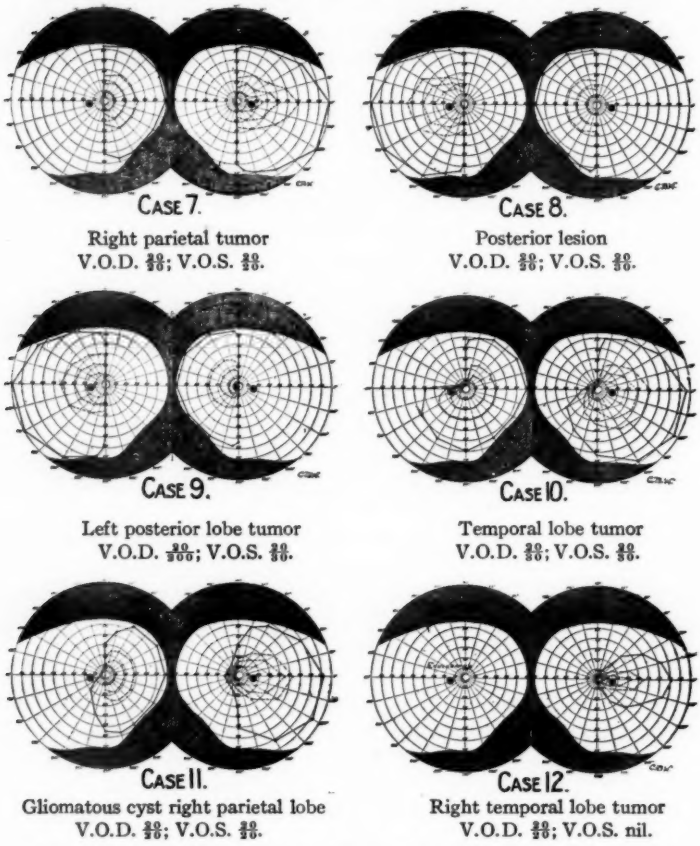

FIG. 4. Typical fields of posterior cases examined. The history and examination for Case 7 is given in the text, but for the other cases only in the *Transactions*.

is now simply turned out and no light appears on the blind side. Sometimes the latter test may be made first. From this point on, the order is not of importance, and a great variety of trials may be carried out in any order.

The method of recording results must be as simple and rapid as possible. Probably the best way is to record the lights by numbers. The patient's chart is outlined on the keyboard. Each key is given a number, which is easily remembered. The displacement is then recorded by the first two numbers and the time by the third number, followed by remarks on the character of the reaction. Record is kept of the reaction time on the blind side only, since the reaction time on the seeing side is very constant and very short, usually in the neighborhood of one-fifth of a second or less. Before proceeding with the examination the field chart is studied and a large series of numbers, indicating desirable displacements, are put down in columns, so that on observation merely the reaction time and occasional remarks need be recorded.

CASE REPORTS.

In all, 26 cases have been examined for the Wilbrand reaction by the electric-light method. The space and figures necessary for the report of all these cases would hardly be justified by the results. Therefore, instead of reporting several cases of similar field type and reaction only one typical case is given. The fields were all taken with the instruments and in the manner previously described in another paper.[1] Only the field for the normal disk is given, since outside of this periphery the test lights are not visible unless close enough to the line of cleavage to be detected by dispersion light.

In the group of anterior lesions the cases naturally fall into three sub-groups, according to the character of their field defects: First, those with complete, incomplete, or more than complete bitemporal hemianopsia; second, those with no vision in one eye and complete or incomplete or more than complete temporal hemianopsia in the other; third, homonymous hemianopsia of tract origin. In the group of posterior lesions, subdivision may be made into complete and incomplete homonymous hemianopsia and cases with loss of vision in one eye and nasal hemianopsia in the other eye.

Certain definite types of refixation movements of the eye have been noted in most of these cases. These have been given

[1] Walker, C. B. "Some New Instruments for Measuring Visual-Field Defects." ARCH. OF OPHTH., 1912, xlii., No. 6.

terms such as pseudo-refixation, central refixation, pseudo-central refixation, angular refixation, and pseudo-angular refixation, which will be described in the somewhat more detailed summary of results given with the first case so that thereafter unnecessary and tedious descriptive accounts may be avoided.

CASE 1. (Surgical No. 435).—Hypophysial struma. September 27, 1912. Mr. H. C. N., aged 42. Failing vision for two years, associated with frequent headaches, diplopia, nausea, and vomiting. Complete bitemporal hemianopsia for over one year. Examination on admission, typical hypophysial struma with evidence of neighborhood disturbances. Well educated professional man. Mental lethargy apparently slight.

Eye Examination. No nystagmus or exophthalmos. Transitory weakness of third nerve with pupillary reaction to direct light on right. Consensual reaction from left eye good. Left pupil reacts well to direct light. Hemiopic pupillary reaction marked by rotary shutter test. Right pupil 3.5*mm* diameter, left 4.5*mm* diameter in ordinary light. Field and vision, Figure 3.

Wilbrand Test.—O. D.: When pseudo-refixation was attempted on the first trial the patient continued to stare at the center for six seconds, then gave a quick glance toward the blind side, and then announced that the light was out. On the next trial the 15° light was flashed as the central light was turned out. The patient continued to look at the center for four seconds and then gave a quick glance toward the blind side as before, but discovered the light this time and refixed on it immediately. Trying now the 30° displacement, the patient immediately looked to the previous displacement and then with a process of seeking found the light. Reaction time two seconds. When the 45° light was tried it was found by the same process in three seconds, and on repetition in two seconds. Patient was apparently familiar with the reaction. A light was displaced to 30° on the seeing side. Instant refixation, but when it was turned out and the 15° light on the blind side was lighted, the patient's eye instantly sought the center and searched for three seconds before the light was located on the blind side. This we have called pseudo-central refixation. The same thing occurred when no light at all was flashed on the blind side. Pseudo-refixation in the horizontal was now marked but rapidly performed, the patient being confident that no light was present in from two to three seconds. Displacements in the 45° axis above or below the mid-line gave what

we have called angular refixation—that is, the eye looked out along the horizontal axis to the blind side until the light was discovered above or below, when it was instantly refixed. The reaction times did not measurably exceed those for the horizontal line, but became reduced on repetition to one second or less for the 15° displacement, to two seconds for the 45° displacement. At first there was a marked tendency on the part of the patient to look at the point where the light had last appeared on one axis and then up or down to the point where it actually was on the other axis. There was no tendency to look directly at the light until several trials, when the patient began to show considerable anticipation of the probable point of next appearance of the light instead of looking at the previous point. Pseudo-angular refixation was now present to a marked degree. That is, when the fixation light was turned off, the eye moved to fix a point on one axis and thence to another point on another axis.

O.S.: The first few tests on this eye were interesting, in that the results were obviously complicated by the experience obtained from examination on the other eye. Thus, when pseudo-refixation was first tried the patient immediately began to search over his seeing field—that is, this eye moved to the same side as before when the light disappeared. The patient evidently then realized his mistake and searched his blind field. This, however, occupied only five seconds before he announced that there was no light. Subsequent waverings toward the seeing side were noted, but the reaction time in the course of two or three tests was the same as in the other eye in the second stage, with all the phenomena present previously described.

Four other cases (S. Nos. 28986 and 29117, J. H. H., and 2 P. C.) with this stage of field defect have been examined, with practically the same result. Those with better central vision refix slightly more rapidly and those with more sluggish cerebration react more slowly. All showed the same type of refixation and pseudo-refixation.

The remaining case histories and examinations of the anterior group may be found in the *Transactions* of the Academy of Ophthalmology and Oto-Laryngology, 1914. The fields for these cases may be seen in Fig. 3 together with that of the above case.

CASE 7 (Surgical No. 397). Right parietal lobe tumor. September 15, 1913. Mrs. C. R. C., aged 44. About eight

months ago left homonymous hemianopsia developed and escaped detection until complete. Later headaches. Choked disk (3½ D.), anæsthesia and weakness of left side of body, dizziness, Babinski, etc., led to diagnosis of right occipital lobe tumor with cerebellar neighborhood signs. Right subtemporal decompression June 10, 1913. On September 21, 1913, a large tumor was successfully removed from the right parietal lobe by Dr. Cushing. Mental condition excellent throughout.

Eye Examination.—Both eyes: no exophthalmos; movements free and complete; no nystagmus; media clear. Fundi show typical picture of receded choked disk of low grade after decompression. With no central scotoma and good macular vision, the left pupil (5*mm* diameter) was definitely larger than the right pupil (4*mm*) in ordinary illumination. Good reaction to direct and consensual light, slight reaction to accommodation. Hemiopic reaction present in both eyes. Fields and vision, Figure 4.

Wilbrand Test.—O. U.: When pseudo-refixation was tested at the first trial, the patient was noted to search about the center with wider and wider swings toward the blind side until at seven seconds, with a glance out to about 50° she said she thought the light was not working. The 15° displacement was refixed in two seconds, with the same sort of seeking movements as in the first test. The 30° light was refixed by a further seeking motion in three seconds. With the 45° displacement, however, the patient looked out almost far enough, then moved the eyes back to the 15° and 30° region, then up and down, and then announced that the light was out again. On repetition, however, it was found in three seconds, with a more rapid seeking motion, out on the horizontal axis. Pseudo-refixation test produced the same movements again, slightly more rapid. Angular and pseudo-angular refixation were rapidly performed now. The light was either found or called out in from one to two and a half seconds in any position. Central and pseudo-central refixation were readily demonstrable.

Three other cases (Surgical Nos. 29996 and 30418, J. H. H., and Surgical No. 1464, P.B.B.H.) have been examined, with practically the same results, though the reaction times were, if anything, not quite so short.

As with the anterior group, only one case in the posterior group can be given in detail as above. While the fields of the remaining cases may be seen in Fig. 4 together with that of the given case, the histories and examinations must be looked for in the *Transactions* of the Academy of Ophthalmology and Oto-Laryngology, 1914.

SUMMARY.

From a study of our series of hemianoptic cases with this instrument many interesting though not practical characteristics are notable. Thus it is notable that certain factors may increase the reaction time in any case, and that the presence of a relative central scotoma may add two or three seconds or more to the horizontal reaction time but does not contribute to much delay in the angular reaction time, perhaps because the peripheral retina along the cleavage line sees the light first, after which direct fixation is very rapid. Again, the reaction time in all cases is increased by introducing variations from simple horizontal displacements, such as angular displacements, change of center, and the introduction of pseudo-refixation tests. Further, any patient with a very poor memory or with depressed thinking or reasoning power shows an increased reaction time. On the other hand, in all cases the reaction time for any displacement may be markedly decreased on repetition, no matter in what way it is made. Also, in this group patients with bright mentality and good central vision always gave the shortest reaction time. In all cases there is a decrease of reaction time with the increase of the displacement, but on account of the decrease of reaction time occurring with repetition it makes a difference in what order the displacements are made. Thus if the small displacement is made first, difference in time reaction is not nearly so marked as when the larger displacements are made first. For this reason it seems fairer to time the small displacements first.

Regarding the phenomena of pseudo-refixation, certain general statements applicable to all cases may be made. If the pseudo-refixation test is the very first test made, the results are quite variable, but at any time later in the trials the results are very constant. When it is the first test, the patient may simply stare at the point where the light disappeared for from five to ten seconds, give a cursory glance onto the blind side, and then announce that the light is out. The more thoughtful group may at once begin to search the blind field over for the light and then give the seeing side a glance before they announce that the light is out. At any time after the

first test made on the blind side, the patient almost invariably looks to the point on the blind side, where the light was last seen, when the fixation light is simply made to disappear without appearing elsewhere in the field.

Besides the simple forms of pseudo-refixation we can also elicit combinations and complex forms depending on the mental characteristics of the patient. Thus, after refixation has been performed on the blind side in any axis, and on the next trial another axis is used, the eye turns with more or less of a searching motion to the point where the light was previously seen, and then jerks upward or downward to refix the light in its real position as a glimpse of it is caught at some point on the line of cleavage between the blind and the seeing retina. This phenomenon we have called ***angular refixation***. It is obviously a combination of pseudo-refixation and real refixation. Again, if the patient has refixed several times from a certain fixation point onto the blind side, and then instead of returning to the fixation point we use a light still farther out on the blind side, the patient's eye will often be noted to seek the center again before searching the blind field for the light. This we have called ***central pseudo-refixation***. This lighting of a light one step farther out on the blind field each time is very confusing to a patient, especially if we change the axis, and there is always at first a tendency to pseudo-central refixation, which in this series decreases on repetition. If after this sort of test we refix the eye on the center and then turn the fixation light out, we may often note, particularly with the more intelligent patients, what we have called ***angular pseudo-refixation***—that is, the eye is seen to move out along some axis to the point of a previous light, and then at an angle still farther out and on another axis, to the point of another previous light. A very intelligent patient usually at about this stage develops a seeking method of beating the game by a systematic search each time the light disappears, in one of two ways—either by moving the eye quickly onto the horizontal axis until the light is or is not discovered above or below, or by a circular motion sweeping the periphery of the blind field each time it is necessary.

It is notable in these cases that the reaction times in anterior lesions, producing homonymous hemianopsia or blindness in

one eye and hemianopsia in the other, are of very much the same degree of magnitude as found in posterior cases, provided mental conditions and central vision are about the same in the two groups. But the reaction times in anterior lesions producing bitemporal hemianopsia may be somewhat greater at first than in lesions, either anterior or posterior, producing homonymous hemianopsia.

In explanation of these findings, however, several factors, independent of the supposed reflex arc, must be considered. Posterior cases have usually acquired rapidly a rather sharp homonymous hemianopsia but with retention of good central vision. These cases have every incentive to learn rapid refixation; objects moving onto the blind field may be plainly seen and followed. Thus the patient naturally develops the habit of looking onto the blind side for objects which have disappeared. This ability of refixation apparently develops according to the mental ability of the patient. The only anterior lesions which could be fairly compared with this group are the rather rare cases of tract lesions giving homonymous defects, and the hypophysial lesions producing blindness in one eye and temporal hemianopsia in the other. Even in these two groups the central vision and the patient's mentality must be on a par with the central vision and mentality in the posterior case to which it is to be compared.

Hypophysial cases having a bitemporal hemianopsia form by far the largest group of anterior lesions. These cases, in binocular vision, have each defective field largely supplied by the good nasal field of the other eye. They have then an effective field of vision extending about 60° from the fixation point in all directions. Accordingly they do not ordinarily observe moving objects disappear on passing to one side of the fixation, and therefore acquire no experience or habit of refixation. It is only in case vision in one eye is entirely lost that they gain such experience. Even with a large central scotoma in one eye, they do not become comparable to cases with complete homonymous hemianopsia, although they do acquire a certain amount of refixation ability. In addition to these considerations it must be remembered that hypophysial cases are suffering from a glandular disorder which produces not infrequently a mental as well as physical weariness. But

even with all these handicaps, cases of bitemporal hemianopsia commonly reduce their reaction times markedly in the second stage of the examination, until they compare very favorably with homonymous cases. Further it may be noted that even in these cases the influence of observation and experience such as is obtained from the examination of the first eye is shown in the examination of the second eye, as a tendency, on the first test, to search in the wrong direction for the light that has disappeared. That is, the second eye is moved in the same direction as the first eye until the patient becomes aware or thinks of the different relation of blind and seeing field in the second eye.

When we compare posterior cases of homonymous hemianopsia with anterior cases of homonymous hemianopsia (tract) and with hypophysial cases blind in one eye and hemianoptic in the other, we find that their reaction times compare very favorably in all respects, even if no great allowance is made for the presence of central scotomas and mental conditions.

After studying the time and character of the reactions in all cases examined, we believe that while the test may be of value to a psychiatrist as a measure of a certain mental capacity, it is of no diagnostic importance in the localization of brain lesions. We now feel certain that phenomena which we have called pseudo-refixation, angular refixation, pseudo-angular refixation, the tendency to central refixation, and pseudo-central refixation, and the marked seeking character of all refixation on the blind side, in all cases indicate the functional result of thought and memory processes rather than a reflex action. It seems to me quite possible that this test could be made available for the armamentorium of the psychiatrist. An instrument as elaborate as the one herein presented would not necessarily be required. One with smaller lights, no larger than an ordinary hand perimeter, could be constructed for portable purposes. One central light and two or even one light on the arms, all movable, could be operated by a battery handle and finger switch so as to give essentially the same tests as herein described. From this standpoint possibly the psychiatrist would be able to give a better idea of the region of the lesion than would the ophthalmologist. Certainly we hope this may be the case.

CONCLUSIONS.

I. The distribution of field defects in anterior and posterior lesions encourages psychological factors, which greatly complicate the Wilbrand test.

II. The tendency to decrease the reaction time on repetition; the presence of seeking movements of the eye at all times during refixation; the presence of pseudo-refixation, angular refixation, pseudo-angular refixation, the tendency to central refixation, and pseudo-central refixation, all invalidate the Wilbrand test as a topical diagnostic reflex.

III. The results obtained by the Wilbrand test are surely a measure of certain processes of observation, memory, and thought, and are not an indication of the integrity of a definite reflex arc.

IV. The possibility that this method of examination may be useful to the psychiatrist and thereby, perhaps, contribute to topical diagnosis, is suggested.

I am deeply indebted to Prof. Harvey Cushing, not only for kindly facilitating this investigation, but also for generously allowing me the privilege of presenting this particular phase of his cases.

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HISTOLOGICAL FINDINGS AFTER SUCCESSFUL SCLEROSTOMY.

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From the Massachusetts Charitable Eye and Ear Infirmary.

(With three figures on Text-Plate III.).

ALTHOUGH during the past five years sclerostomy[1] for the relief of glaucoma has been widely performed, few cases have been reported in which the eyes have come to microscopic examination, and most of these, naturally enough, have been unsuccessful cases. In fact, only three eyes successfully operated upon by this method seem to have been examined. Two were briefly described by Holth (3), the other by Bachstez (4), and all three eyes were removed after death. In the case here reported, the eye was removed during the life of the patient on account of a small intraocular sarcoma, and was therefore free from post-mortem changes.

Case.—Emil J., aged 30 years, was admitted to the Massachusetts Charitable Eye and Ear Infirmary May 21, 1914. He stated that at intervals he had suffered slight pain in the left temporal region for about a year. Four days before admission he had noted for the first time that the vision of the left eye was much impaired. There seemed to

[1] This term (1) first suggested by me in 1910, seems to have met with considerable favor. Objection has been raised to it by Hay (2) on the ground that it is not strictly analogous to such terms as gastrostomy, enterostomy, etc. Such strict analogy seems to me unnecessary. A more valid objection is the fact that the opening is not confined to the sclera, but on the inside of the eye passes through the cornea. The term, however, is certainly preferable to "trephining" since the operation is not necessarily done with a trephine.

be a cloud before the eye, and at this time there was considerable pain in the eye itself. The pain had diminished (under miotics) but vision had remained blurred.

On examination the right eye was found normal, with a tension of *20mm* (Schiotz). The left eye was moderately congested and the cornea decidedly hazy. The anterior chamber was not apparently shallow and showed what was supposed to be a small hyphæma. The pupil was dilated and somewhat eccentric. The fundus could not be distinctly seen owing to the corneal haze. The tension was *60mm;* the vision $\frac{20}{200}$.

On May 24, 1914, sclerostomy, combined with a large buttonhole iridectomy, was performed by Verhoeff's method. The conjunctival flap was made large, and the incision made almost parallel to the limbus as recommended by Elliot. The episcleral tissue was excised from a small area at the site selected for the scleral opening. Atropine solution was instilled immediately after the operation.

Following the operation the anterior chamber became fully reëstablished in less than a week, but at the end of the week it became abolished again and the eye became very soft. Ophthalmoscopic examination now showed a large separation of the choroid on each side. These disappeared in about a week, the anterior chamber became reëstablished, and the tension of the eye became normal. A definite bleb was formed at the site of the sclerostomy. The patient was then discharged to the Out-Patient Department, eighteen days after the operation. About a week later it was noted that the supposed hyphæma had increased in size and was distinctly blackish. Sarcoma of the ciliary body was strongly suspected, but ophthalmoscopic examination and transillumination were still negative. The tension was still normal. Atropine was discontinued.

Three weeks later the mass at the bottom of the anterior chamber was larger, and ophthalmoscopic examination showed the edge of a dark mass at the extreme periphery of the fundus below. Transillumination now gave a definite shadow. The diagnosis of sarcoma of the ciliary body was made and enucleation advised. The eye was free from congestion and showed a well-marked translucent bleb above the site of the sclerostomy. There was slight cupping of the disk on the temporal side only. The visual acuity was $\frac{20}{100}$ and the visual field contracted, the limits being, with a *.5cm* disk, 35° inward, 35° downward, 40° upward, and 70° outward.

Retinal hemorrhages were observed after the sclerostomy, but the exact time when they were first seen was not noted.

Enucleation was performed July 15, 1914, seven and one-

ILLUSTRATING DR. VERHOEFF'S ARTICLE ON HISTOLOGICAL FINDINGS AFTER SUCCESSFUL SCLEROSTOMY

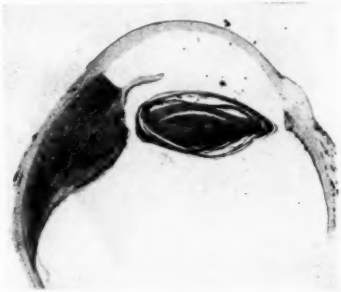

FIG. 1.—Showing the sarcoma of the ciliary body, only the margin of the scleral fistula is included in the section, but the overlying "bleb" is well shown. Photo x 3.

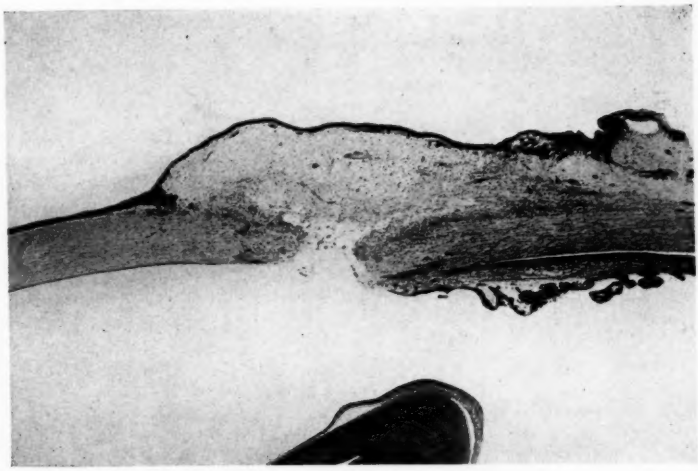

FIG. 2.—Section passing through about the middle of the fistula. Note the delicate tissue partly filling the latter. The larger black dots within this tissue are sarcoma cells. Photo x 18.

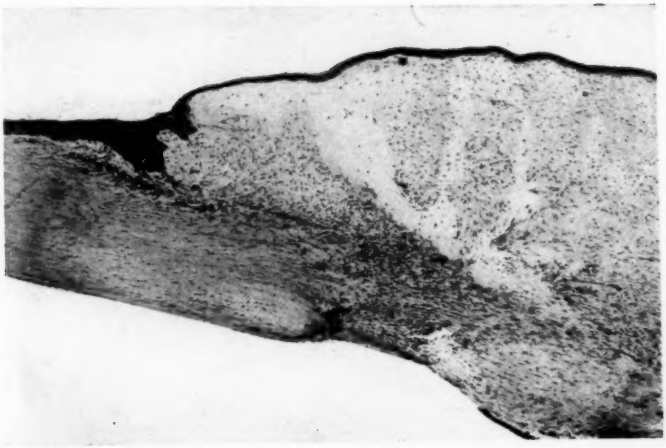

FIG. 3.—Showing large space in "bleb" extending up immediately beneath the epithelium. The section passes through the margin of the fistula and thus shows the tissue proliferation that has occurred in its wall. Photo x 50.

half weeks after the sclerostomy. Care was taken not to traumatize the bleb and to leave a considerable margin of conjunctiva intact around it.

PATHOLOGICAL EXAMINATION.

Macroscopical.—The cornea is clear. The anterior chamber, of normal depth, is free from coagulum. The lens is indented by the tumor and pushed slightly upwards. The iris shows a large buttonhole beneath the site of the sclerostomy. There are no posterior synechiæ.

The diameter of the bleb over the scleral fistula is *3mm.* The retina shows numerous hemorrhages, most of them small and punctate. Anterior to the equator some of them are *2mm* in diameter. The choroid and retina are *in situ.*

Histological.—Fixation in formalin followed by saturated solution of potassium bichromate. Celloidin embedding. Serial sections through sclerostomy opening. Longitudinal sections of optic nerve and disk nearly to central vessels. Serial cross-sections of central vessels.

The tumor (Fig. 1) is found to be a moderately pigmented, actively proliferating spindle-cell sarcoma. It entirely replaces the ciliary body below, and has destroyed the ligamentum pectinatum here, extending over the posterior surface of the cornea for about *1mm.* It has pushed the root of the iris away from its normal position, thus increasing the depth of the anterior chamber here to *1mm.* Posteriorly the tumor gradually loses itself in the choroid. The ciliary epithelium and the pigment epithelium of the retina are for the most part still present over its surface, though greatly altered, but in places the pars plana has been broken through and the bare tumor projects slightly into the vitreous chamber. The ciliary processes have not been invaded but are compressed against the lens by the tumor. The sclera is slightly invaded along some of the perforating vessels, and in places foci of tumor cells are seen around vessels in the episcleral tissue. Along the sclera the tumor shows old areas of necrosis markedly infiltrated with fatty endothelial cells, and containing cholesterine crystals surrounded by foreign-body giant cells.

The cornea is normal. The iris shows slight fibrosis and slight ectropion uveæ. The cut edges of the iridectomy wound in some places are not healed over, the stroma here being in direct contact with the aqueous, but in other places they are covered over by an extension of the pigment epithelium. The iris root above is firmly adherent to the ligamentum pectinatum, but in general is little if at all thinned. On the sides the root is free.

The filtration angle, both directly above and on the sides, contains a greater or less number of tumor cells, evidently originally metastatic from the aqueous humor. Above, they form small nodules in the line of adhesion of the iris root. On the sides, they completely fill up the spaces of Fontana. In many places they extend into the canal of Schlemm and even continue into its venous collaterals.

The ciliary body and its processes away from the tumor are normal, except above where the epithelium of the processes shows proliferative changes evidently due to contact with the lens. The latter is normal.

The choroid, except where it is invaded by the tumor, is normal. The retina shows numerous punctate hemorrhages and a small amount of hematogenous pigment associated therewith. The ganglion cells are still present apparently in normal numbers in the macula and on the nasal side, but have disappeared on the temporal side anterior to the equator. The optic disk is slightly depressed and the lamina cribrosa curved backwards. The nerve stem in the region of the lamina cribrosa shows an early stage of cavernous atrophy and neurogliar proliferation.

The Sclerostomy Wound.—The fistula is partly filled with an extremely delicate connective tissue almost free from cells (Fig. 2). Caught within its meshes are a few tumor cells evidently deposited from the aqueous. (Fortunately they are too few to have complicated the process.) The tissue evidently has originated not from the sclera, but from the tissue of the bleb. Within it are numerous irregular, ill-defined empty spaces which communicate with other spaces which open directly into the anterior chamber. The latter are thus analogous to iris crypts. The free surface of the tissue is not covered with endothelium, nor are the spaces or crypts.

The edges of the scleral fistula show evidences of recent proliferation, with formation of new fibrous tissue and increase in the number of fixed cells. This, no doubt, has resulted from the trauma of the operation. The lumen is therefore somewhat smaller than it originally was (*1mm*). There has also been some proliferation from the outer surface of the sclera everywhere beneath the bleb. The new tissue resulting has a much denser character than that of the bleb itself, and in places has extended as a thin layer over the outer end of the fistula, thus becoming a sort of cribriform plate with wide irregular openings. Descemet's membrane ends abruptly about *.5mm* from the edge of the fistula, apparently having retracted from the opening. The corneal endothelium continues almost to the edge of the fistula, but nowhere extends into the latter. The outer edge

of the fistula is about .5*mm* from the canal of Schlemm. The root of the iris remaining after the iridectomy is firmly adherent to the corneosclera and is much thinned. It does not quite reach the edge of the fistula. In the line of adhesion there are a number of sarcoma cells, as already mentioned.

The bleb over the fistula consists of a highly œdematous delicate connective-tissue meshwork containing stellate fixed cells, and closely resembles the unpigmented stroma of a normal iris. It contains few blood-vessels and shows no infiltration with chronic inflammatory cells. Within it occur irregular communicating spaces which at first sight appear entirely empty, but which on closer examination are found to be partly filled with a barely visible connective tissue, free from fixed cells, continuous with the surrounding stroma. This tissue is even more delicate than that within the fistula. None of the spaces is lined with endothelium. Some of the large spaces extend up immediately beneath the epithelium, as shown in Fig. 3.

The epithelium over the bleb is thinner than that of a normal conjunctiva, due to a reduction in the thickness and number of the squamous cells on the surface. Another noticeable change is that the basal cells are evidently swollen, being increased in size and having a more transparent and less deeply staining cytoplasm than is normal. These changes are especially marked in the epithelium over the large spaces just described.

Anteriorly the bleb extends over the cornea somewhat beyond the normal position of the limbus. Posteriorly it ends rather abruptly in dense fibrous tissue. Here there are a number of foreign-body giant cells enclosing minute particles probably introduced at the time of operation, and also a small amount of hematogenous pigment. Laterally, as shown by the examination of numerous sections, the œdematous tissue of the bleb passes insensibly into the untraumatized conjunctival tissue. The latter seems to show slight traces of œdema even to the middle horizontal line, but this is difficult to determine with certainty owing to the necessarily small amount of conjunctiva left here at the enucleation. At the periphery of the bleb the subepithelial tissue shows moderate infiltration with lymphoid and plasma cells.

When first seen the case was regarded by me as one of chronic glaucoma in which an acute attack had supervened. The eye was only moderately congested, although the tension was high (60*mm*) and the cornea steamy. The history of loss of

vision of only a few days' duration was attributed to faulty observation on the part of the patient. After several days, the tension not responding to miotics, sclerostomy was performed.

The dark mass, at first barely visible at the bottom of the anterior chamber, exactly simulated a hyphæma. As it grew larger, however, I suspected its real nature, owing to its dark color and to its pushing the root of the iris backward (as shown in Fig. 1), although ophthalmoscopic examination and transillumination were negative. The patient was kept under observation and finally it became possible to demonstrate the tumor both with the ophthalmoscope and transilluminator. Enucleation was then performed at once, seven and one-half weeks after the sclerostomy.

The tumor, a melanotic spindle-cell sarcoma, was found to replace the ciliary body below and extend into the anterior chamber. It presented no features of special interest, except possibly its small size, its active proliferation, and its intraocular metastases.

The duration of the glaucoma in this case is difficult to determine. The slightly atrophic condition of the iris and the complete blockage of the filtration angle would seem to indicate considerable duration. Above, the iris root was firmly adherent to the corneosclera, while below, the filtration angle was filled up by direct extension of the tumor. Everywhere else the ligamentum pectinatum was overgrown with tumor cells evidently metastatic from the aqueous humor. The slight cupping of the optic disk, on the other hand, would seem to indicate a short duration for the glaucoma, although it is possible that the excavation receded after the tension was lowered by the sclerostomy.

A feature of some interest in this case was the occurrence of separations of the choroid a week after the operation. These occurred on each side, were very large, and had no relation to the tumor, completely disappearing in about a week. The generally accepted explanation for such separation is that a slight cyclodialysis is produced by the traction on the iris incident to the iridectomy, so that when the intraocular pressure reaches a certain height the anterior chamber empties itself into the subchoroidal space. In the present case no traces of a present or past cyclodialysis could be found, but no

doubt a small one could have healed without leaving any visible trace.

The retinal hemorrhages also noted in this case no doubt resulted from the great reduction in tension immediately following the sclerostomy. They were so abundant as to suggest obstruction of the central vein, but serial cross-sections of the optic nerve showed both central vessels practically normal.

The chief interest in this case relates to the sclerostomy and its effects. This was carried out by the method described by me five years ago, but with one modification, namely the excision of the episcleral tissue from the region in which the opening was to be made. My reason for this was my belief, based upon the microscopic examination of a few unsuccessful cases, that the closing of the scleral opening, when not due to incarceration of the iris or lens, was chiefly due to proliferation of the episcleral tissue. In the present case this modification was certainly a success, but further experience with it than I have yet had is needed to determine whether or not it should be adopted as a routine procedure.

While my method of performing sclerostomy has certain disadvantages, it has seemed to me to possess important advantages over the Elliot method. In the first place the keratome incision may be so directed that the inside opening is farther away from the ciliary body than the outside opening. As a result, when the sclerostomy is made the fistula is slanted away from the ciliary body. By Elliot's method the fistula, on the contrary, is slanted towards the ciliary body. By my method there are no tags of tissue remaining on the edges of the opening, whereas by Elliot's method the whole disk is not cut out cleanly by the trephine, but the disk remains hinged and is cut away by means of scissors. This must leave a ragged edge favoring tissue proliferation. By my method there is less danger of injuring the lens, and the disk cannot be lost into the anterior chamber. The chief disadvantages are that more care is required to avoid buttonholing the conjunctiva, and the special instrument employed easily becomes dulled and requires frequent resharpening.

In successful cases of sclerostomy the conditions finally obtained are no doubt practically the same whether the opera-

tion is done by the La Grange, the Holth, the Elliot, or my own method, so that the anatomical findings in the present case are no doubt of wide application. That the operation was successful in the present case was shown by the fact that a typical so-called bleb was formed and that the tension was reduced from 60*mm* to 30*mm*. That the result would have continued indefinitely in a case of primary glaucoma I am certain, because I have never seen a bleb fail to persist that was translucent and free from inflammation seven weeks after the operation.

On microscopic examination it was found that the "bleb" was not really such in the ordinary sense of the term, but that it consisted of an œdematous delicate connective-tissue meshwork closely similar to iris stroma.[1] Ramifying within this tissue were irregular communicating spaces, some of them comparatively large (Fig. 3), which were incompletely filled with connective tissue so extremely delicate as to be barely visible. None of the spaces were lined with endothelium or had definite walls. Evidently they resulted from the distention of the tissue by the intraocular pressure. Some of the large spaces extended up immediately beneath the epithelium so that the latter was in direct contact with the aqueous humor.

Especially instructive was the relation of this œdematous tissue to the scleral fistula. Instead of being raised up from the latter, the tissue extended down into it to about two-thirds of its depth. Within the fistula, however, the tissue was extremely delicate and on its inner surface presented occasional openings similar in size and appearance to iris crypts, through which fluid must have escaped from the eye into the bleb.

Thus, although as dimly seen through the bleb the fistula appeared open, it was really incompletely occluded by delicate tissue.

In the two eyes[2] examined by Holth (3), one, six months after an Elliot, the other, three years after a Holth punch operation, he describes only the scleral fistulæ, and makes no mention of the way in which the latter communicated with the blebs. In

[1] In spite of this fact I continue to employ the term for the lack of a better one.

[2] In addition to these two eyes, Holth examined microscopically an eye that had been successfully operated upon by iridencleisis.

fact, he fails to describe the blebs at all. Possibly post-mortem changes rendered the external structures of the eyes unfit for careful study. In both cases the fistulæ were lined to a greater or less extent with iris pigment, and therefore Holth holds that the incarceration of iris tissue in the wound is a distinct advantage, and states that he endeavors to have this take place. Elliot, on the other hand, endeavors to avoid this, maintaining that it favors closure of the scleral opening. Certainly it is not essential to successful results for the fistula to be lined by pigment epithelium. This is proved by the present case in which the fistula was free from iris pigment. Nevertheless, it seems possible, at least under certain conditions, that incarceration of some iris tissue in the wound may be advantageous, as has been noted after ordinary iridectomy and iridodesis.

Bachstez (4) examined microscopically three eyes upon which sclerostomy had been performed, but in only one was the result successful. On this a Lagrange operation had been done fifteen days before the death of the patient from pneumonia. Clinical notes regarding the eye condition subsequent to the operation were lacking. There was a definite fistula found in the sclera over which the conjunctival tissue was œdematous but not elevated. The wall of the fistula was not lined with epithelium. No mention was made of cyst-like spaces in the œdematous tissue. Probably after a longer period of time the conditions would have become essentially the same as in my case.

Elsewhere (5), I have brought up the question whether or not, after sclerostomy, the fluid escapes mainly in the manner generally assumed—that is, through the tissue spaces of the conjunctiva. It seemed to me that the sharply circumscribed character of the bleb indicated that little fluid could escape from it into the surrounding conjunctiva, and that probably most of it passed through the epithelium into the conjunctival sac. The findings in the present case, while not conclusive evidence, lead me to believe that this view was erroneous, and that the fluid really escapes chiefly by way of the surrounding tissue, although no doubt a certain amount diffuses through the epithelium. For all the spaces in the bleb were in communication with each other and with those of the uninjured

conjunctiva at each side. Egress of fluid was cut off only in proximity to the line of the conjunctival incision where there was formation of fibrous tissue. The pressure was necessarily greatest directly over the scleral opening, while towards the periphery it must have become rapidly less owing to the wider area of tissue receiving the fluid and to the resistance already encountered. Hence the limitation of the cystoid condition to a circumscribed area about the scleral fistula.

In connection with the question of the efficiency of the drainage outlet after sclerostomy, it seems to me that, in addition to the pressure under which the intraocular fluid is secreted, another factor requires consideration. This is, the rate of total secretion against given pressure. For it by no means necessarily follows that because two glaucomatous eyes have equal intraocular pressures their rates of secretion would be equal, especially against equal lower pressures. With a slow rate of total secretion it is obvious that an extremely small outflow would suffice to reduce the intraocular pressure to normal. Possibly this condition obtains in cases, occasionally met, in which no bleb has formed and the scleral fistula has apparently closed, yet in which the intraocular pressure has been permanently reduced to normal. On the other hand, in cases with a high rate of total secretion, the intraocular pressure might remain high in spite of a voluminous bleb and an extremely large outflow. Perhaps it is to this type to which most cases of hemorrhagic glaucoma belong.

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TRAUMATIC PULSATING EXOPHTHALMOS,[1] WITH COMPLETE BIBLIOGRAPHY.

By ARTHUR J. BEDELL, M.D., F.A.C.S., Albany, N. Y.

(With one photograph on Text-Plate IV.)

TRAUMATIC pulsating exophthalmos is of sufficient rarity to warrant the presentation of this case.

Mr. J. R. L., aged 39, May 31, 1913, was riding on a large open street-car which was derailed against a tree and he was thrown to the ground, striking his head. After immediate care in the Mercy Hospital, Pittsfield, his physician, Dr. A. E. England, who has kindly given me his report, found him the next day dazed, with all signs of true fracture of the base of the skull: bleeding from the nose, ears, and mouth, with vomiting. No paralysis of the face, all reflexes normal. The mind cleared in about four days and memory was gradually regained. Hearing on left side lost, and there was slight ptosis of the left upper eyelid, with constant complaint of dizziness and headache. On July 6th, about five days after the accident, the patient "felt something like electricity" at the upper corner of the left orbit, which was found to be a definite pulsation and bruit. At that time, there was marked diplopia, dilated pupil, and beginning proptosis.

The patient, when sent to me on May 7, 1914, by Dr. Leo H. Neuman, complained of a constant noise in his head and a terrible headache.

The right eye: vision $\frac{20}{30}$, Jaeger 1. Eyeball decidedly proptosed, 30*mm* by Hertel's exophthalmometer with limitation of outward motion. The veins of the lids, especially those at the inner corner of the upper one, prominent and

[1] Presented in part at meeting of Academy of Ophthalmology, etc., Boston, Oct., 1914.

tortuous. Conjunctiva of the lower half of the ball and the lower lid congested, with many full, dilated, tortuous veins, especially one in the lower cul-de-sac, which extends from the nasal side to within *6mm* of the temporal margin. Pupil *3.5mm*, active to light and accommodation, tension normal, media clear, disk slightly oval, axis 90°, sharply outlined, with small central excavation. Both retinal arteries and veins overfull, especially the latter; no hemorrhages although the disk congested. No palpable pulsation of the eyeball.

The left eye: vision $\frac{20}{50}$, Jaeger 2; the proptosis is much more marked than on the right side, *40mm* by the Hertel instrument. An extremely large mass of tortuous dilated blood-vessels on the upper lid. In the upper-inner corner of the orbit is a large dilated vessel, about *2cm* in diameter, transmitting a distinct bruit. Visible pulsation of the globe. Entire conjunctiva congested, with numerous dilated veins of bright red color greatest over the inner half of the globe. Pupil *3.5mm*, active to light and accommodation, tension normal, disk round; extremely full, tortuous, constricted, and distended retinal veins; occasional pulsation of retinal arteries, no hemorrhage or exudate. Limitation field of motion, eye turned in 30 degrees, abducens paralysis. Bruit most intense over the left supraorbital ridge although felt over the entire head. A systolic blowing murmur heard over the same area is stopped by carotid pressure.

Left ear: Thin gray retracted membrane. Hearing so reduced that only the high notes are heard at *2cm*. Large perforation of the cartilaginous septum of the nose.

Dr. Neuman in his complete examination found the apex beat in the 6th space, systolic pressure 120, diastolic 82.

On May 29, 1914, the first photographs were taken. The right eye was prominent, vision $\frac{20}{50}$, Jaeger 2; the vessels on the upper eyelid tortuous and the bulbar conjunctiva congested. The left eye, vision $\frac{20}{50}$, Jaeger 6, showed a greater dilatation of the ophthalmic vein, eyelid vessels over-distended, bright red congestion of the entire eyeball, extreme exophthalmos visibly pulsating. By tropometer, moves 15° down, 10° up, 30° to right, 0° to left.

X-ray examination failed to show any fracture, although there was very evident separation through the frontal bone, extending from deep in the left orbit to the vertex between the parietals. The course of this depression is outlined by the large ophthalmic vein shown in the photograph.

Wassermann and Noguchi tests negative.

Slight contraction of the field of vision for form as seen by the charts.

Pressure on the right globe reduces the ball, which then pulsates; the same pressure on the left causes a partial re-

ILLUSTRATING DR. BEDELL'S ARTICLE ON A CASE OF TRAUMATIC PULSATING EXOPHTHALMOS

Definite mass in inner corner of left orbit. Fullness of vein which outlines the palpable separation between the frontals, congestion of skin, tortuous vessels in upper eyelid, and congestion of bulbar conjunctiva.

placement with very strong pulsation and the patient complains of dizziness.

Carotid pressure or pressure on the ophthalmic vein deep in the left orbit stops the pulsation and bruit. Change of position has no effect on the exophthalmos, although lying down increases headache.

On October 4, 1914, the bulging vessel is decidedly larger, being 4 x 1¾*cm* in its widest part, over the supraorbital ridge. A new venous dilatation is now seen on the right side over the lacrimal sac. This 2 x 1*cm* pulsating area was not present until this date.

October 4th, O. D.: vision = $\frac{20}{?}$ (?), Jaeger 1. Bulges 29*mm* by the Hertel instrument. Pupil 3.5*mm*; no further change in the fundus. O. S.: vision = $\frac{20}{100}$, Jaeger 6, 37*mm* by Hertel. Globe directed forward and inward but not depressed. Disk margin above and below somewhat blurred.

The margin of a definite dull congestion of the skin, starting on the right side of the nose, has gradually widened over the forehead until it is now about 7*cm* at its widest part. There has been no improvement in the general condition of the patient, the diplopia is unaltered, but as yet he will not consent to operation.

In 1907, de Schweinitz and Holloway published a monograph of great value, considering spontaneous and traumatic exophthalmos up to July of that year. The following brief summary covers the cases of traumatic exophthalmos recorded since their article, and also refers to three spontaneous cases, only one of which, however, did not appear in their report.

Yvert refers to Gasparrini's case reported in June, 1906, and included in the previously published reports but again cited because of the treatment. Case of exophthalmos reducible by compression with pulsation murmur. Disappearance of symptoms on compression of the carotid, administration of potassium iodide, and instillation of adrenalin for ten days.

Beauvois reports two cases. The first, a woman of 41, fell down-stairs fracturing the base of her skull. A month afterward, right-sided exophthalmos without pain. Systolic murmur. Later, right-sided abducens paralysis, diminished vision, exophthalmos. Ocular and carotid compression without result. Ligature of the common carotid three months after accident, cessation of the murmur with slight

aphasia and left lid paresis. Persistence of the exophthalmos, although somewhat lessened, with gradual loss of vision. Ten days later, reappearance of the murmur, which could, however, be stopped by compression of the left carotid. Injection of 5*cu cm* of 1% gelatinized serum into the thigh every other day. After three injections murmur lost. Injection increased to 20*cm*, then to 50*cm*, at last to 100*cm*. Exophthalmos disappeared, but paralysis of both abducens and slight dilatation of the pupil persisted. Three months after beginning of treatment, local cure.

Second case, a woman 53 years of age, had received a severe blow beneath the right eye with the handle of a pump, ten years before. First seen December, 1905. In August, 1905, intense pain in the right side of head. At the end of December, 1905, diplopia, exophthalmos, conjunctival reddening, systolic murmur. Fundus slightly congested. Vision, right eye, 0.4; left eye, 0.6; paralysis of the right abducens. Visual field slightly diminished. Injection in the thigh of 2½% gelatin every five days. After the 22 injections, exophthalmos reduced one-half, with normal motion, and complete disappearance of the diplopia.

Santos Fernandez saw a man of 47, December 16, 1905. Forty-two days before, he had been struck by a hammer, which rendered him unconscious for three days. Upon regaining consciousness, noise in head with moderate exophthalmos and ptosis. Pupil normal. Conjunctiva congested. Compression of the carotid caused disappearance of symptoms. On the 24th of December, started injection of 2% solution of gelatin and 2% of sodium chloride; by the 20th of January much better. Pulsation stopped and exophthalmos disappeared.

Becker cites the case of a soldier who was wounded by the explosion of his gun on May 26, 1906. Four wounds on the right side of face, two upon nose, one at the corner of his mouth, and another in the right eye. On the tenth day, protrusion of the left eye, which increased steadily in the following days. Retina showed hemorrhages, and the movements of the eyes became more and more limited until entirely lost. On the eighteenth day pulsation appeared. Compression of the carotid caused diminution of the pulsation. Skiagraph showed a fragment of bone 2 x 1.5*cm* in the neighborhood of the sella turcica and in the cavernous sinus. July 3, 1906, ligature of the internal carotid. Relief for four weeks and then return of the former symptoms, but in eight weeks great improvement. After three months, further improvement. Vision with a $+4 = \frac{5}{15}$. Lateral movements of the eyeball normal.

Jacques reports a man of 25 who was injured in a motor-

cycle accident by falling against the wheel, striking on the right side of head, fracturing the base of the skull. Three weeks later, pulsating exophthalmos. Intense epistaxis nine times in six weeks from the right nose, which occurred after any strong effort. Ligature of the right common carotid. Three days later, improvement, but after a short time recurrence of all symptoms. Still later, operative exposure of the inner portion of the orbit. A polyp was found in the sphenoidal sinus which communicated with the cavernous sinus. Sphenoidal sinus packed with iodoform gauze which was removed on the sixth day without hemorrhage.

Pooley reports a negro of 30, struck on the back of the head by a "spliced blackjack." Three wounds on the scalp, one on the parietal bone near its junction with the occipital, one farther forward, and another on the temple. He was felled by blow and rendered unconscious. Upon regaining consciousness, he was greatly disturbed by a most distressing noise in the head. Two days later, all symptoms of arterio-venous aneurysm present except pulsation. Eye protruded, blood-vessels of the conjunctiva and lids dilated. No pulsation of the eyeball detected, but when the ear was applied over the globe blowing murmurs and a continuous whirring, rumbling sound were heard. The eye could be pushed back into the orbit by the hand. Compression of the carotid diminished but did not stop the bruit. No change in the fundus and vision seemed unimpaired. Patient too illiterate for exact vision. Treated for a few days by a pressure bandage and compression of the common carotid. On March 16th, ptosis, exophthalmos, enormous dilatation of the vessels of the conjunctiva and lids, pulsation easily obtained especially near the inner canthus, papillitis with enormous dilatation of the retinal vessels. One vein in the lower temporal region seemed to be obstructed and, above and below the obstructed portion, was greatly distended. Noises in the head had become more aggravated and to this was added occasional violent pain in the orbit. There was no impairment of hearing. Patient would not consent to operation.

In discussion of Dr. Pooley's paper, Dr. Knapp stated that he had had three cases, in all of which the ligation of the common carotid had relieved the bruit, exophthalmos, and chemosis, but the optic nerve went on to atrophy.

Oppenheimer had seen a case some years ago in which the carotid had been ligated. Secondary hemorrhage with fatal result had followed. It proved to be an erectile tumor.

Claiborne ten years ago had seen a case like Dr. Pooley's. He had applied pressure bandage, which was kept up for

eighteen months, and had administered mixed treatment internally. A perfect cure resulted.

Gruening had seen the vision immediately restored after ligation of the carotid in a case operated upon some years ago without anæsthesia.

Tyson has seen atrophy follow the tying of the common carotid, although the other symptoms had subsided.

Flemming and Johnson saw a male of 47, September, 1907, who, although previously in good health, fell, striking back of his head, and was unconscious a few minutes. A month later, left hemianopia, no proptosis, but soon afterwards constant beating noise in the head. April 19, 1908, left eye markedly proptosed, lids slightly swollen and congested, conjunctiva deeply congested, with chemosis, especially in the lower fornix. Pupils equal, active to light and accommodation. Distinct pulsation of the left eye with limitation of all its movements. Marked continuous murmur with systolic exacerbations over the left eye and skull. Pressure on common carotid stopped murmur. Right eye, vision $= \frac{6}{12}$. Left eye, vision $= \frac{6}{24}$. Right half each field blind. Fundi normal. May 14th, left common carotid tied, at level cricoid cartilage, and pulsation stopped.

Barrett and Orr cite the case of a male aged 50 years, who ten weeks before, while intoxicated, fell and remained unconscious rom 24 to 36 hours. In hospital for three weeks. No evidence of organic lesion. Six weeks after the injury he complained of buzzing in the ears, and a few days later his right eye was prominent, with vision $\frac{6}{18}$. The lower lid everted, marked exophthalmos in the middle line, conjunctiva of the lower lid engorged and much swollen, fundus veins dilated. The external canthus was divided and the orbit explored, the finger being pushed behind the eye where a pulsating mass was felt. March 2d, a marked bruit over the temporal bone and the eye synchronous with the pulse. March 4th, vision as before, but eye was almost stationary with many hemorrhages and distended veins in the fundus. Neither rest nor medical treatment stayed the progress, so the common carotid artery was ligatured March 11th. Steady improvement, exophthalmos diminished until comparatively slight at the last examination; the movements of the eye returned in part, the action of the external rectus being most limited, and the hemorrhages disappeared from the fundus. Bruit, lost after the operation, returned about a fortnight later, then gradually disappeared again. In October, there was slight proptosis. Vision $\frac{6}{12}$.

Barbieri tells of an Italian, male 43 years old, who reported on the 24th of April, 1907, with an intense pain in the temporal region. On the succeeding day the left eye became

prominent and a month later the right eye pulsated. Injection of 5% gelatin tried without result. October 21st, ligature of the right common carotid. The exophthalmos and pulsation continued. On January 8, 1908, the left common carotid was tied. On the 4th of April, the day of his last examination, the exophthalmos continued, the movements of the ball moderately free, pupil inactive to light, headache slight, protrusion and subjective noises persisted.

C. S. Merrill in a personal communication has told me of Miss E. T., aged 50, who fell from a wagon, striking the back of her head, on July 5, 1909. When seen there was much chemosis on left side, with extreme pulsating exophthalmos and aneurysmal bruit. Compression of the carotid stopped the bruit. Vision, right, normal; left, nil. Dr. A. W. Elting ligated the left external carotid. All symptoms were relieved and the eyeball returned to proper position. Some months later, vision, right eye, with correction $\frac{20}{20}$. Left vision, objects to the outer side; optic atrophy.

The wheel of a loaded wagon passed over the head, just back of the eye, of a 24-year-old male, January 29, 1909. Halstead and Bender report that he was unconscious three days. Left eye bulged more at the time of accident than it did when he entered the Infirmary, when it was turned sharply toward the nose and appeared paralyzed. The lids were swollen and it was impossible to close the upper lid, move the jaw, the tongue, or to swallow. Roaring noises synchronous with the heart-beat could be heard from the time patient regained consciousness until he entered hospital. He remained in bed for two weeks following accident, during which time the sight in his left eye became much impaired. Examination made on August 27, 1909. The left eye turned in 45° and was very prominent, $\frac{2}{3}$ of an inch farther forward than the right. Veins on the outside of the upper lid were very large and tortuous. The blood-vessels of the sclera were also dilated. Cornea vascular and over a 4*mm*-square area in its center there was a fairly dense cicatrix. Vision, right eye, $\frac{20}{30-3}$; left eye, $\frac{20}{120}$. September 28th, vision right eye $\frac{20}{20}$, left eye $\frac{20}{50}$. On October 10th, a pulsating tumor felt over the lid and in the inner angle of the orbit; bruit heard over the left temporal region and patient complained of constant roaring noises, heard most distinctly in the left ear. On October 14th, left internal carotid ligated near its origin with chromicized catgut. At present the left eye turns inward and there is some exophthalmos but no bruit.

Lane's patient was struck on head with a brick, three months before fracturing his nose. Twelve days later, ectropion lower lids, marked œdema. Vision $\frac{8}{200}$. Right

eye enormous dilatation, retinal veins, small hemorrhages about disk. Pulsation, bruit, exophthalmos. Blowing sound left ear. Pulsation continues over left temporal region with accentuated systolic murmur. Only general treatment and K. I. On June 10th, patient sat up for first time. 5 A.M. 11th, aphasic with right facial paralysis. On September 2d, no pulsation, faint systolic murmur, vessels conjunctiva bright red color. Vision left eye $\frac{4}{6}$.

Orloff's pulsating exophthalmos developed six months after a deep wound in the region of the left parietal and temporal bones in a thirty-year-old patient. A successful result followed ligature of the ophthalmic vein in the depths of the orbit after a temporary resection of the external wall of the latter.

Friedenwald's case of a colored female of 20, although not of traumatic origin, is recorded because of the absence of bruit.

Halstead reports a male of 36, who was struck twice on the left temporo-malar region with a hard instrument February 20, 1910. Unconscious a short time thenwalked home; blood from ears and nose. Facial paralysis next day and roaring in the ears. Two months later, when the left eye was enucleated for panophthalmitis, orbital contents prolapsed. Vision, right eye $\frac{20}{40}$. Diagnosed as pulsating tumor base of brain, probably aneurysm. October 5, 1910, stump left eye removed. Right eye signs of beginning venous stasis. Roaring in ears heard through head, long loud bruit over malar regions. Common carotid and two divisions of superior thyroid ligated. Immediate disappearance bruit. No brain symptoms.

Zeller's patient, 35 years of age on December 24, 1894, shot himself in the right temple beneath the zygoma and in front of the ear. Unconscious. Three weeks after the injury, exophthalmos with ecchymosis on the right side. January 24, 1895, exploration of the right orbit. Vision $\frac{1}{3}$. Movements of the ball limited. Globe directed downward and inward with abducens paralysis. March 5, 1895, exploration on the site of old operation of the neck. Carotid removed between ligatures with no improvement. On April 13, 1895, resection of the frontal bone opening the orbit. An attempt to tie the cavernous and carotid sinus within the orbit resulted in intense hemorrhage and death in eight hours. Autopsy showed that part of the bullet had engaged almost at the apex of the petrous portion of the temporal bone, having entered the internal carotid and the cavernous sinus.

Kraupa, in 1894, saw a 20-year-old man who, while in bathing, dove from a dock two meters in height and who,

before he came to the top of the water, felt an intense sound in the left ear, which in the next few days constantly increased. Typical pulsating exophthalmos of the left eye. No operation.

McClellan tells of a man of 32, who was injured eight months before. A machine at which he was working upset, striking him on his chin. Unconscious twenty-four hours, with considerable hemorrhage from both the mouth and nose but none from the ears. Slight exophthalmos developed three months later, which grew steadily worse until both eyes were decidedly prominent, especially the right. A distinct pulsation, rhythmical with the pulse, could be seen and felt, also more on the right eye. The conjunctiva was very œdematous and the veins very markedly dilated. Movements of the eyes and visual fields for form normal, but it was impossible to obtain the color fields. Vision, right eye $\frac{9}{20-3}$; left eye $\frac{20}{20-3}$. Bruit audible over the bifurcation of the right common carotid and reached its maximum intensity about one inch behind the external angular process of the right frontal bone. Distinctly audible over the left side but not so marked and of a different character and higher pitch. By compressing the right common carotid the bruit and the pulsation of the eyes stopped. Compression of the left carotid had no effect. Vision reduced to $\frac{20}{50}$ in each eye. Ligation right internal carotid with immediate cessation of the bruit and pulsation of the eyes. No return. In one week the engorgement of the retinal veins and choked disk disappeared and vision returned to normal, although the conjunctiva was still congested and the exophthalmos only slightly reduced.

Lystad's 15-year-old stoker was shot with a revolver bullet through the right nose in August, 1902. Spastic hemiparesis with incomplete anæsthesia. Three months in hospital. Resumed work nine months later. Two years after the injury, increasing swelling over the right eye, with exophthalmos and a systolic murmur. Five years after the accident he was struck with a fist, when he again came to the clinic. Eye movements then normal. Pupil slightly small. No pulsation. Subjective and objective disturbances completely lost on digital compression of the right carotid. September 17, 1907, ligature of the internal carotid and the external carotid and jugular vein. Temporary improvement. After a time pulsation and exophthalmos returned. In November, 1907, electrical treatment considered worthless. In beginning of 1908, condition about the same as before the operation. Patient was unable to work. January 24, 1908, orbital operation by Schiotz. After three weeks an objective improvement, but still an intense headache and slow pulse.

In the following week swelling became less and pulse normal. Out of bed for the first time in two months. Vision, fingers at 2 meters; visual field contracted, tension plus. After a few months the patient was able to work again and the protrusion was hardly noticeable. The glaucoma, however, increased, miotics having no effect. Conservative operation not permitted by patient. Eye was enucleated in December, 1908, after which he had no headache and the murmurs were great only when lying down.

Risley reports two cases. The first was knocked unconscious by a fist blow on the ramus of the right jaw. Four weeks later pain in the head, diplopia, and confusion. Proptosis of right eyeball about 10*mm*, swelling of the lid, conjunctiva chemotic with full veins near the inner canthus. Limitation motion except downward. Systolic pulsation best heard over the right eye. Vision = $\frac{6}{12}$.

The second case was a male of 30 who three years before had had his head caught between a trolley car and an express wagon. Unconscious seven weeks. Abducens paralysis, slight proptosis of the right eye. Loud blowing systolic bruit heard over the entire skull but loudest over the right eyeball and left frontal. Bruit lost on right carotid pressure. X-ray negative in both cases which are still under observation.

A man 18 years of age who had been struck on the head with a piece of iron was seen by Ginzburg. Unconscious fifteen minutes with bleeding from the mouth and nose. On examination hemorrhage in the left lower lid. Right lid swollen, ptosis marked, injection and protrusion of the fixed globe, and definite systolic pulsation. December 7th, ligature of the right common carotid. No change, so March 27, 1911, clamping of all vessels within orbit by forceps, which were left in the wound. March 30th, protrusion of the eyeball greater than before the operation. July 17th, protrusion very much less. August 10, 1911, ptosis slight, thickening of the bulbar conjunctiva. Protrusion entirely disappeared. Eyeball freely movable. No conjunctival hyperemia, no pulsation. Vision, right eye, 0. Vision, left eye, 0.5.

Savariaud examined a small girl who after having had her head squeezed between a large plank and a boat had a hemorrhage from the right ear and nose. Later paralysis of the abducens on the right side, exophthalmos, and a continuous murmur with systolic emphasis. Slight pulsation. Injections of gelatin after Lancereaux's method failed.

James and Fedden's first case, fell nine feet, striking on his head, became unconscious but only had a scalp wound, some bruising over the right fronto-parietal region, with bleeding

from the nose and a double black eye. The right pupil was semi-dilated and sluggish in its reaction to light, while the reaction on the left side was brisk. On the next day there was very extensive ecchymosis on both sides, that on the left being the more marked. Ten days later, left-sided ptosis and a pulsating exophthalmos. Treated by a rest in bed and a pressure bandage. Three weeks later, a commencing keratitis e lagophthalmos, so the lids were sewed together. Three days later, the left common carotid was tied. After a couple of months, no exophthalmos or pulsation in the orbit; when the lids were separated, the left palpebral fissure was slightly smaller, the left pupil contracted, the vision $\frac{6}{18}$, and that of the right $\frac{6}{6}$.

Second case, female aged 53; four and a half weeks before she had fallen down some steps and became unconscious. Small wound over the right external angular process. Kept in bed for three weeks, but when she began to go about complained of right-sided headache and the right eye began to swell. A normal recovery from her initial head injury; for the first few days there had been considerable subconjunctival ecchymosis which had rapidly absorbed. No ocular palsy. Pupillary reactions normal until she got up when there was right-sided ptosis with proptosis, moderate œdema of the ocular conjunctiva with dilated veins. Eye stationary, the pupil dilated and fixed. Vision, fingers 6 ft. Very marked venous pulsation of the disk which seemed to jump forward at each beat. No pulsation of the globe. Put to bed with a pressure bandage and given iodides internally. Two days later, definite pulsation in the orbit and a faint systolic bruit over the right temporal fossa. Proptosis increased with headache and buzzing noise in the head. Bruit plainly heard over the eye, forehead, vortex, and temporal fossa. The right internal carotid tied just above the bifurcation stopped pulsation. Five weeks later, patient discharged, slight proptosis, very light œdema of the conjunctiva with fullness of the veins and marked pulsation of the disk. When last seen, ten months later, eye moderately convergent, abducens paralysis. Upward and downward movement fair. Vision, right eye, Hm. $1:5=\frac{6}{18}$; left eye, Hm. $1:5=\frac{6}{6}$. The external recti remained paralyzed and the disk pale.

Buchtel operated August 13, 1912, on a patient who was struck on the head with a pitchfork three months before. He had a buzzing sound in his head and in a few days the left eye protruded; well marked exophthalmos, forward and downward. Pulsation of the eyeball and the mass at the upper-inner angle of the orbit, with a continuous bruit and systolic accentuation over the brow and temple. Complained of the noise, diplopia, and headache. Fundus nega-

tive. Operation: Incision, eyebrow, angular; superficial and temporal veins tied and superior ophthalmic ligated as far as possible in the orbit. More œdema at first, but no bruit, pulsation, or fundus change. Exophthalmos gradually lessened. Vision = $\frac{20}{20}$.

Buchtel also reports two other unrecorded cases: one a double exophthalmos cured by ligation of the common carotid; the other, unilateral, died after the same operation.

Matthewson saw a male of 32 who had been thrown from top of car October 8, 1910, fracturing the base of the skull. November 5th, left eye very much proptosed with complete ptosis. Considerable swelling of the conjunctiva and much restricted motion of the globe. Fundus negative. Vision, fingers 8 ft. in the upper field, the lower field lost; no pulsation of the globe. December 20th, veins upper lid much dilated, ball pulsated, slight pallor nerve, slight dilatation retinal veins, no bruit, occasional headache. March, 1911, vision a most gone. In August, condition more marked. Loud blowing murmur left temporal heard over greater part of skull. September 5th, common carotid artery tied. Month later, little proptosis, no bruit or pulsation.

Cunningham's case was that of a male, 39, who four years before received a severe blow left cheek; that night felt badly; spat blood. Two days later roaring in his head began, gradually worse. Two months later, sudden pain right temple with marked protrusion eyeball. Right common carotid clamped. Bruit and pulsation lessened at once, lost in four days, although two months later exophthalmos still present. Later, clamp removed by operation.

Maher saw a man of 35 who ten months before had had a blow on his head with a stick, was unconscious thirty hours and dazed a week. Three weeks after injury, right eye began to protrude and throb with marked pulsating exophthalmos, controlled by pressure on the right common carotid. Bruit over eye and temporal region. Marked engorgement conjunctival vessels, œdema conjunctiva, pupil dilated, retinal veins dilated and tortuous, marked œdema optic disk and retina. Headache and whirring noise in head. Right internal carotid tied. Pulsation ceased at once. Exophthalmos diminished. Three years later no exophthalmos, slight pallor disk, and only occasional headache.

The second case, a male of 19, fell 45 feet, fracturing the base of the skull. Unconscious several days. Six weeks after injury, left eye began to protrude and for some weeks progressed, then gradually subsided; the right eye became more prominent. Pain and noises in the head. Right eye proptosed and convergent, conjunctiva œdematous, vessels

full, limited motion of the globe up and down, no motion outward, pupil normal, retinal vessels slightly tortuous and dilated. Vision $\frac{5}{18}$, Jaeger 1. Left eye not proptosed, movements upward and downward limited. Pupil dilated. Disk pale. Vision $\frac{5}{21}$, Jaeger 2. Loud bruit over right eye and temple. Left internal carotid tied. One month later, marked subsidence, eye moved up and down but not out, headache better, but bruit persisted, vision same.

De Schweinitz and Holloway collected 54 cases of traumatic pulsating exophthalmos, making a total of 214 on record in 1907. Since then 32 others have been recorded, making a grand total of 246.

In a summary made from the 32 here correlated it is found that common carotid has been ligated 14 times, resulting in cure in 4, improvement in 6, failure in 4; internal carotid, cure in 2, improvement in 4. One case was later cured by the removal of a polyp in the sphenoid sinus extending from the cavernous sinus. Orbital operation has resulted in 3 cures and 1 failure; gelatin cure in 1, improvement in 1, failure in 1; no operation as yet reported in 5; one case died after an attempt to tie the cavernous sinus after ligature of the common carotid had failed.

It is impossible to draw conclusions from the cases here detailed, partly because of the small number and partly because the mere citation of treatment does not explain the actual condition demanding the operation. Ligation of the common carotid is the operation most often performed, but as it may cause death, many fatalities having been recorded, the other operations should receive greater attention in the future. After a careful study it seems that ligation of the superior ophthalmic vein is an operation that should always be done after ligation of one common carotid has failed, and in many cases may be advised as the primary procedure. Although three cases have been cured by the injection of gelatin, it is not here recommended, nor is the treatment by drugs, rest, or even the compression of the carotid.

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CONCERNING REMOVAL OF THE EYEBALL.

II.

FAT IMPLANTATION.

By HARRY S. GRADLE, M.D., Chicago.

(With three figures in text.)

IN considering the second phase of this subject, I have confined my discussion to the implantation of fat into the scleral or orbital cavity.

The implantation of an extraneous substance into the empty scleral capsule dates from the first report of Mules (1 and 2) who used a glass ball. This idea for enlarging the stump upon which the prothesis rests, obtained immediate favor and there followed shortly various modifications. Kuhnt (3) and Schmidt (4) implanted a silver ball, Bunge (5) an ivory one, Pick (6) rubber, Claiborne (7) glass wool and asbestos, Bryant (8) aluminum, Hertel (9) paraffine, Schmidt (10) a flamed bone sphere made from the head of the femur of an ox, Elschnig (11) decalcified bone, or a pith ball (12), Alter (13), Oatmann (14), and Spratt (15) paraffine, and so forth. Practically all sorts of solid and semi-solid substances were implanted within the scleral capsule. But nearly all operators have rejected these operations for two reasons: the implant is apt to be extruded, even without visible cause, as late as many years following the operation; and in case of choroidal remnants, the implant causes an irritation that has frequently led to an outbreak of sympathetic ophthalmia (see literature in first article of this series).

Apparently, the first implantation into Tenon's capsule

after enucleation was performed by Lang (16), who used a glass, celluloid, or silver ball and sutured the muscles over the implant. Over ten years elapsed before another implantation into the orbit was recorded, when Lagrange (17) reported the results he obtained by inserting a complete rabbit's eye, cornea backward, into the empty capsule of Tenon. Shortly after this, Roemer (18) injected paraffine into the capsule. This same procedure was adopted by Ramsey (19) who reported 34 cases with four failures and one subsequent sympathetic ophthalmia (certainly not due to the paraffine). Davis (20) claimed that a sympathetic irritation was due to a lump of paraffine in Tenon's capsule, extending to the apex of the orbit and pressing upon the nerve. Suker (21) implanted preformed paraffine into both the scleral and Tenon's capsule. The same technique was used by Spratt (22) in 40 cases in which he claimed that the paraffine became surrounded by a connective-tissue capsule. Nicolai (23) followed Lagrange's technique of implanting a rabbit's eye into the empty capsule of Tenon, except that he placed the cornea facing anteriorly. This was followed by another report from Lagrange (24). Wicherkiewicz (25) tried this method in 32 cases with only one failure. Five years later, the same author (26) proposed implanting a piece of the patient's skin and subcutaneous fat, rolled up and tied with a piece of catgut. The individual muscles were sewed together over this.[1] So many other implants, together with minor variances in operative technique, have been advocated that a mention of all would be interminable: hollow glass ball, Greenwood (27); glass ball, Schmidt (28); pith ball, Elschnig (29); lead-free glass ball, Suker (30); simple evisceration without keratectomy and inversion of empty sclera, Gifford (31); etc.

The first operator to implant autogenous fat into the empty capsule of Tenon was Barraquer (32) in 1901. He obtained the fat from the gluteal region. Seven years later, Bartels (33) reported two similar successful cases. He also performed the operation upon a dog, and three and a half months later, excised the implanted fat. This was found to have shrunk but little, and was forming a perfect funnel-shaped mass, pointing toward the apex of the orbit. Ohlemann (34) used thi

[1] Sattler (45) implanted cartilage obtained from the rib into the empty capsule of Tenon after enucleation.

character of implant for several years, but did not report his cases in number or detail. Implanted fat, obtained from the shoulder, was used in five cases by Velez (35) and by Rollet (36). In 36 cases of fat implantation into Tenon's capsule, Lauber (37) experienced six failures. Owing to his method of suturing the muscles over the implant, he found a certain amount of shrinkage to occur during the first two or three months. Marx (38) did not suture the muscles and did not speak of any shrinkage occurring. Good results were reported by Jacob (39) in one case, Ibershoff (40) in one case, Alling (41) in one case, Tschirkowsky (42) in 35 cases from the Axenfeld Clinic, and Waldstein (43) in the first 20 cases from the Elschnig Clinic. Weidler (44) spoke of the prolonged convalescence in three cases and reported a shrinkage of nearly one half of the amount implanted.

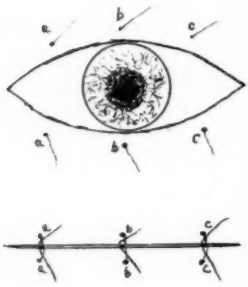

Fig. I

The operation of evisceration, combined with intrascleral implantation of fat, does not vary from the simple operation except in the last stages. If the evisceration is to be performed without subsequent implantation of fat, the section of the sclera is oval-shaped so that the wound after closure is linear (Fig. I.). But when an implant is to follow, the excision of a quadrangular section of cornea and sclera is necessary. As much of the latter as possible is to be preserved. From the four corners of the opening, four oblique incisions are made, forming four scleral flaps

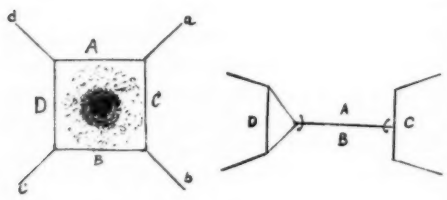

Fig. II

(Fig. II.). After the scleral capsule has been eviscerated and the hemorrhage stopped, adherent remnants of choroidal tissue must be searched for and carefully removed. Any such adherent particles not only militate against the successful inclusion of fat, but are a constant source of danger to the fellow eye. When the scleral capsule has been proven to be clear, it should be packed and tightly compressed with a sterile gauze to stop further hemorrhage. The retaining sutures may then be laid through the lips of the scleral wound. The flaps A and B should first be drawn together and sutures placed through the corners so that upon tying, the knots are buried

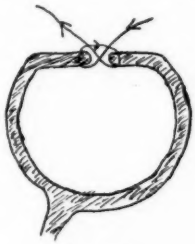

Fig. III.

(Fig. III.). Similar silk sutures are then placed through the corners of the flaps C and D so that these will overlap the first two. The knots are also buried. The accompanying diagrams illustrate the course of the sutures.

The gluteal region, from which it is preferable to obtain the fat, can then be sterilized by the procedures usually employed in cleansing any field for a general surgical operation.[1] Anæsthesia is best produced by the subcutaneous use of novocaine and adrenaline, and sufficient time (at least three minutes) must be allowed to elapse before making the incision. Hurry is inadvisable, for time is required for the pressure to control the intrascleral hemorrhage. The gluteal incision should be made as nearly parallel to the course of the fascia as possible—that is, along the course of the gluteus maximus. The subcutaneous fat immediately springs into view and a piece of the necessary size can be dissected out and preserved in a sterile square of

[1] Cleansing with a $\frac{1}{10}$% alcohol-sublimate solution (80% alcohol 100: bichloride 0.1) followed with tincture of iodine.

gauze. An assistant sutures the wound, while the operator removes his gloves and cleanses his hands, preparatory to inserting the fat into the scleral capsule. This must be done under the strictest aseptic precautions.

The piece of fat inserted should be about two centimeters in diameter. Too small a piece does not fill out the scleral capsule, while too large a piece defeats its own object in that it results in extrusion. The lips of the scleral wound are held open by forceps in the hands of assistants and the fat inserted. A broad spatula then holds it in place while the sutures of the first pair of scleral flaps are drawn taut and tied. These sutures of silk of the two pairs of scleral flaps are then buried under a linear suture of the conjunctiva. A rather firm bandage should be applied for at least forty-eight hours.

The implantation of fat within Tenon's capsule does not require any marked variance of technique from the simple enucleation. After a typical enucleation, a purse-string suture of silk (No. 2) is passed through the open mouth of Tenon's capsule, so as to include, if possible, the four ends of the recti muscles. It is better to insert this suture through the conjunctiva, and make it emerge nearly so that the knot will be extra-conjunctival. In obtaining the fat, the same technique is used as for fat to be implanted within the scleral capsule, except that a larger piece is necessary. The implant should have a diameter of at least three centimeters and should be packed firmly into the capsule, forming a funnel-shaped mass of tissue. The purse-string suture through the mouth of the capsule is drawn tight over the whole mass, and a linear suture of silk (No. 0) closes the conjunctival wound.

Fat, in contrast to implants of other character, is a live pliable tissue that requires but little nourishment. It is homogeneous with the tissues of the orbit, and, unless infected, causes absolutely no irritation. As shown by the experiments of Bartels (46), it conforms to position and forms a funnel-shaped mass, with the apex toward the rear wall of the orbit. The nourishment necessary to keep the implanted fat alive until the vessels can penetrate the mass is surprisingly small. The perfect elasticity of the fat tends to form a cushion upon which the prothesis rests with great ease, and is under the control of the muscles.

In the following chart are tabulated 29 cases of enucleation and 54 cases of evisceration with fat implantation. The general diagnostic headings are the same as those described in the first article of this series. In all but two of the enucleated cases, the fat healed in without trouble. In one, the fat was simply extruded for some unknown reason. The enucleation was performed because of a phthisis bulbi dolorosa, and on the third day the fat sloughed out. Secondary sutures were inserted but these pulled through. The patient was discharged on the thirteenth day with a small stump under the prothesis. In the second case of enucleation, the extruded fat was accompanied by some sterile pus. It was a case of subluxated traumatic cataract, following a perforating injury by a piece of brass. On the second day, light projection became faulty and the eye was removed. On the fourth day, the wound gaped and some fat was extruded accompanied by a small amount of sterile pus. On the thirteenth day, the wound was still open in one small area, but the patient was discharged.

Among the 54 cases of exenteration, the fat was extruded in six, three times without known cause. Two of the cases were perforating injuries and the third was operated upon for secondary glaucoma after an adherent leucoma. In two further cases, the fat was accompanied by a small amount of pus that contained pneumococci. Both were infected perforating injuries. In the third case, a corneal ulcer existed, the eye was exenterated, and on the eleventh day the entire mass of fat, accompanied by sclera and pus, sloughed out. Pneumococci were found in the pus.

Enucleation.		*Evisceration.*
29	Number	54
23	Ganglion Anæsthesia	34
6	Other Anæsthesia.	20
0	Acute Mycotic.	5
1	Acute Non-Mycotic.	4
0	Chronic Mycotic.	0
9	Chronic Non-Mycotic.	18
19	Non Inflammatory.	27
27	Fat healed in.	48
1	Fat extruded.	3
1	Fat extruded with pus.	2
	Fat extruded with pus and sclera.	1

The average length of stay in the hospital did not vary greatly for the two different operations. Nevertheless, some of the cases of exenteration suffered intense chemosis of the conjunctiva for several days following the operation. But this was not necessarily accompanied by extrusion of the implant. There were but five cases of acute infectious trouble, as beginning panophthalmitis, operated upon, and in three of these there was intense œdema of the conjunctiva, followed by sloughing of the implanted fat. We have, thus, a distinct contraindication to fat implantation.

In about half of the cases, the implanted fat was found to have shrunken eventually to about one half of the amount implanted. But this shrinkage can be counteracted by a very simple procedure. A needle is introduced into the center of the mass and slight suction applied. This is to find out whether a blood-vessel has been punctured. If no fluid appears, sterile white vaseline may be injected until the stump is of the desired size. About one to one and a half centimeters will be found requisite. In about three days, the prothesis may be worn again. This procedure is dangerous in those cases of simple operation without fat implantation, for the vaseline is apt to wander, especially into the eyelids. The fat cushion forms an excellent medium for the retention of the injected vaseline.

It is impossible to tabulate the results of these cases and, in lieu of photographs, general conclusions must suffice. The stump following enucleation with fat implantations yields cosmetic results about equal to those following simple evisceration. The implantation of fat into the eviscerated scleral capsule far surpasses the results that can be obtained by any other method, and there results a large, freely movable stump of living tissue, distinctly elastic in character.

IT IS CONSEQUENTLY ADVISABLE TO ENDEAVOR TO IMPLANT AUTOGENOUS FAT INTO TENON'S CAPSULE OR INTO THE SCLERAL CAPSULE, IN EVERY CASE OF REMOVAL OF THE EYEBALL BY ENUCLEATION OR EVISCERATION, EXCEPT IN THE PRESENCE OF ACUTE INFECTION OF THE COATS OF THE EYE.

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ON THE TECHNIQUE OF EVISCERATION.

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A RECENT review in these Archives (Sept., 1914, 558) of my article on "Technique of Evisceration" (*Ophthalmoscope*, Jan., 1914) contains a misprint which reverses my opinion on an important point. The review quotes me as saying that in doing an evisceration it is better to do a keratectomy even when a Mules's operation is done. What I really said was, that it was better *not* to do a keratectomy under those circumstances. My position is that there is no excuse for cutting out the cornea no matter what form of evisceration of the eyeball is done, except where it is the seat of active infection. If a Mules's operation is to be done, making the cut through the sclera one eighth to three sixteenths inch above the cornea, and leaving the latter intact, allows a larger ball to be used with less danger of extrusion than if the cornea is excised. No fear need be entertained as to the sensitiveness of the cornea where this is done. It loses most of its transparency and becomes as insensitive as the rest of the surface of the globe and a far better stump is obtained. Where a glass globe is not introduced, the best plan is to make a cut across the cornea and out into the scleral tissue for at least one fourth inch on each side. This allows the interior of the globe to be swabbed out and inspected carefully so that there is no danger of overlooking any small tumor or any adherent bits of uveal tissue. Then by pushing the anterior half of the globe well back toward the posterior wall with a large globular swab an inch or more in diameter, coated with oxide of zinc ointment to prevent its sticking, a large flat stump is obtained which makes a much better support to the periphery of an artificial eye than could otherwise be obtained without the introduction of an artificial vitreous.

THE OPERATIVE TREATMENT OF RETINAL DETACHMENT.

By Prof. Dr. A. ELSCHNIG, Prag.

Translated by Harry S. Gradle, M.D., Chicago, from the *Archiv f. Augenheilkunde*, Vol. LXXVII., 1 and 2.

THAT there is no unanimity regarding the treatment of detachment of the retina is probably due to the numerous variations in the clinical picture of the disease, as well as to the innumerable etiological factors. Only by a comparison of the many forms of treatment practiced upon a large material, other factors being equal, may progress be expected. Consequently, I present my observations upon the various approved methods of treatment carried out in my clinic during the past six years.

As far as possible, I endeavored to proceed with certain measures during certain definite periods. These were: puncture underneath the retinal detachment, either alone or combined with some form of cauterization of the sclera; then the Müller scleral excision according to the original technique and later embodying a modification of my own. During the past five years, we have practiced vitreous replacement, as well as puncture, in connection with the injection of various fluids, and since Birch-Hirschfeld's publication (10), have used his method, which, in substance, varies but slightly from the technique I formerly employed.

In considering this subject, I will discuss each procedure separately, although frequently various methods were tried on one and the same eye in succession. It is therefore impracticable and nearly impossible to present didactical statistics regarding the effect of each procedure. I must confine

myself to the impressions made upon me by the clinical course of each case and mention but briefly the histories of the variously operated cases (except the six cases of simple vitreous replacement) that led me to form these conclusions.

Upon 73 patients, there were 83 operations performed. During the period of the Deutschmann procedure (in short, "incision"), according to his last modification (4), the smallest number occurred (10 operations on 10 different eyes); individual puncture was employed 48 times, puncture with cauterization 42, Deutschmann incision 10, scleral resection 16, puncture with vitreous injection 25, and simple vitreous injection 6 times.

In no case was operative interference attempted until the usual conservative measures had been tried. These consisted of absolute rest in bed or in an upright position, sweats, iodides, inunctions in cases with luetic histories, continued use of pilocarpin or eserine, pressure bandage, repeated subconjunctival injection of salt solution, etc. Attention was paid to the position of the head, so that any advance, as in the case of a detachment of the upper segments of the retina, would not involve the macula. I believe this to be of value. But otherwise I cannot persuade myself that any of these conservative measures exerted any appreciable influence during the time that was allowed to elapse before interfering with surgical measures.

In that, I partially agree with Deutschmann (4) who entirely discards the conservative treatment of retinal detachment. There are, however, some cases where these measures are of value, but we are not able to determine, *a priori*, which procedure is best suited to the case in question. The proof of this is in the early appearance of a cyclitic cataract soon after the detachment of the retina has occurred, without any treatment having taken place. We see many such cases.

I do not believe that subconjunctival injections have the slightest effect upon detached retinæ proper, but unquestionably they do exert a decided influence upon vitreous opacities, especially of a hemorrhagic nature, and thus secondarily become important in the treatment of detachment of the retina. We avoid the use of hypertonic salt solutions of high concentrations, for their use results in bulbar adhesions that are

not negligible, are very painful, and offer no advantages over the solutions of lower concentration. Frequent injections of a 2% salt solution yield results of equal value.

In 44 cases, no operation was performed. In about one-half of these cases, conservative treatment was used over a sufficient period of time, while, in the other half, operation was refused. It must be added that our clinical material does not lend itself well to lengthy periods of treatment, and frequently patients will leave before we can proceed to such operative steps as are deemed advisable.

In three of the cases treated over a longer period of time, there was a reattachment of the retina. In one of them, however, a myopia of 15 D. led to another detachment within two weeks, and the vision was lost. In the second case the vision increased from fingers at 1 meter to 0.1 with a −13.0 D. lens, although it must be confessed that the patient was observed only three weeks. In the third case there was a keratitis parenchymatosa punctata and a circumscribed opacity and questionable detachment of the retina in the periphery only. This disappeared entirely. The vision before as well as after treatment was 1.0. It is possible that there was an exudative detachment of the chorioid. Among the other cases, there was one distinct improvement shown by an increase of vision from fingers at 1 meter to 0.2 with −16 D. Four times a slight increase in vision (up to fingers at 4–5 meters) or improvement in the visual field could be seen, while the rest of the cases showed either no improvement or a distinct retrogression.

Although not strictly included within the realms of this communication, I wish to insert a few brief generalities about these cases of retinal detachment because of their influence upon the conclusions drawn from operative interference.

Fourteen cases resulted from perforating injuries (three were myopic), while in three cases (5 eyes), extraction of the lens with vitreous loss was the chief cause. In one of these latter, however, there was a high grade of myopia (Case No. 60). In two further cases, a tumor could not be positively excluded. In the remaining 99 cases, the second eye was emmetropic or only slightly emmetropic, otherwise normal in 22. In 12 further cases the second eye was myopic to a minor degree,

but otherwise normal and with good function. In 34 cases, the second eye had been injured by a retinochorioiditis of the high myopic type (V equaling fingers to at most 0.3). In 11 cases there was a bilateral amotio retinæ; in 12 cases, cyclitic cataract; twice phthisis following amotio; and twice blindness following traumatic iridocyclitis. There were three further cases of blindness resulting from a severe vascular disturbance of the retina (highly myopic), and four from degeneration of the cornea after parenchymatous keratitis and chronic glaucoma.

Thus we see that in 25% there was a bilateral detachment, two of which were emmetropic, while the rest were myopic to a high degree. There exists thus the probability that a retinal detachment in a myopic individual will become bilateral in over one-fourth of all cases. This percentage is thirteen times greater than in the case of emmetropia.

The frequency of blindness from cyclitic cataract following detachment of the retina speaks to a certain extent for the value of the trea ment. For, with but one exception, none of these eyes had been previously treated.

In the 110 eyes with non-traumatic detachment of the retina, in which the refraction could be determined, only 23 were nearly emmetropic. As 87 were myopic, we have a subsequent relationship of one to four. Tears or solution in continuity could be found in 17 eyes (13%), but in many cases the vitreous was so dense that a careful examination was impossible.

In only one case was there a large tear in the detachment in the neighborhood of the ora. In the majority, the defect was in the nature of a small hole. A long time ago, I was able to prove (5) that tears in the retina appeared at the beginning of the detachment, resulting from irregular adhesions between the chorioid and the retina, which were forcibly torn apart. A series of observations upon these cases has convinced me of the actual occurrence of such retinal tears, which have also been proven by the anatomical examinations of Treacher-Collins (6). Dimmer (7) also showed another way in which these defects appear; that is, as a result of an already detached portion. In several cases, I was able to observe directly the formation of these defects in the detached retina; in one portion of the gray retina, an area would become more transparent, the red color of the fundus would be visible, and within a few

days a defect in the form of a hole would be found. This did not always occur where the retina was under particular tension. These were in the form of round hole-like defects and never a slit, so that I believe that their existence is dependent upon a solution of the retinal tissue. The thought naturally presents itself that albuminous decomposition products appear in the stagnant subretinal fluid and that from these there results a tissue-solving proteolytic action upon the retina (autolytic ferments).

Other etiological factors prove to be nephritis, arteriosclerosis of a high degree in two cases, and syphilis in three. Two of the patients had passed through a keratitis parenchymatosa, while in two other individuals (3 eyes) there have been repeated attacks of iritis due to diabetes. Among the cases conservatively treated were two diabetics. There was a congenital iridochorioidal coloboma in one eye, while in several cases (3 emmetropic) the detachment followed immediately upon a febrile disease (dental periostitis, appendicitis, influenza). Cysts in the detached retina were found, ophthalmoscopically, in one case.

I wish to call attention to a clinical feature appearing during the course of the detachment first described by Schnabel (2). Although this has not received much attention in the literature, still in 1908 Lauber (3) went into details, and even Deutschmann (4). In rare cases of spontaneous detachment of a high degree, the eyeball suddenly becomes mushy; the anterior chamber very deep, and the lens and iris tremulous, the latter discolored to a yellowish green. Several times during the conservative treatment of a detachment, we were able to observe this phenomenon; also in the intervals between operative procedures. It appears to be independent of the latter and usually disappears within a few days. The most plausible cause is that, by a sudden contraction of the vitreous framework, vitreous fluid is pressed through the posterior chamber into the anterior. I would not care to express my opinion as to whether this phenomenon can be attributed, as Schnabel did, as to a nerve influence. In all of the observed cases, this extraordinary process, apparently extremely dangerous, disappeared spontaneously within a few days. From a prognostic standpoint, it is of no material value.

As a rule, conservative treatment does not restore the function of the retina, with the possible exception of these few cases in which early demarcation of the detachment occurs. By that I mean, retinochorioiditic adhesions at the edges of the detachment, thus preventing further retinal separation and loss of function. From these, as well as older observations, I believe that a good prognosis can be given only when the disturbance is based upon chorioidal disease. Then the reattachment, with at least partial restoration of function, occurs within a few weeks; but, as I have previously observed (5), if the spontaneous reattachment takes place after months or years, the function of the retina is never perfectly restored.

These observations, as well as the theoretical considerations, inevitably lead to operative interference in detachment of the retina, for this supersensitive structure is bound to be disturbed by the derangement of its nutrition supply, and a certain amount of destruction will result from the albuminoid decomposition products in the subretinal fluids, as I described when speaking of acquired defects. These albuminoid products unquestionably further lead to nutritional disturbances of the lens, resulting in opacity and to secondary iridocyclitis. The observations of Birch-Hirschfeld prove that this subretinal fluid, when injected into the vitreous, causes an intense irritative effect, as was to be expected; consequently, a procedure aimed at perforation of the retina, with the idea of allowing the subretinal fluid to mix with the vitreous—if this has not already occurred as the result of defects—does not seem logical to me.

Not alone is secondary cataract and iridocyclitis to be regarded as the result of the albuminoidal decomposition, but also the peripheral retinochorioiditic stripes of demarcation. These must be considered as a valuable asset in that they prevent spreading of the detachment. They probably have the same origin as the subsequent retinochorioiditic stripes of reattachment.

From these figures, we can see that the prognosis in a case of unilateral retinal detachment, with fair function of the second eye, is not as poor as it was formerly believed to be. The frequency of bilateral involvement was mentioned above. Now we may consider the results of operative interference,

which, although not brilliant, still were of great value in the cases where second eye was blind from iridocyclitis and cataract.

1. Puncture of the Retinal Detachment.

Punctures were performed in various manners. In those cases of sufficiently prominent eyes a broad cataract knife or a keratome was introduced through the conjunctiva near the equator and continued through the sclera slightly to one side. When possible, the puncture was made underneath the greatest prominence of the detachment, usually below (to one side of the meridian line). The instrument was turned and the subretinal fluid was allowed to run out.

In a greater number of cases, a Rectus, usually the inferior, was temporarily detached.

Only in 3 cases did I follow the method advocated by Sachs (1) (after tenotomy of a Rectus, puncture near the posterior pole of the eye). I discarded this procedure, because it offered no great advantages and because in one case it was followed by a terrific hemorrhage into the vitreous.

In a few cases, I attempted the method recommended by Fuchs (8): withdrawal of the subretinal fluid through a glass tube at the point of puncture; Mooren's method, which recently has been advocated by Birch–Hirschfeld (10) and which consisted in the withdrawal of the retinal fluid by a Pravaz syringe, was tried and discarded as well as the former. The latter procedure has the advantage that it is possible to determine accurately the amount of subretinal fluid withdrawn. We will return to this point later. In a series of cases, a pressure bandage was applied after the puncture. In another series, the eye was covered merely by a moist dressing lightly applied with a protective glass. After this, as well as other operative procedures, atropine was always used. After every operation, the patient was kept lying, and then sitting, in bed for a week and was not examined ophthalmoscopically. With the exception of two cases, in whom the puncture was combined with vitreous injection, we always expected to find a descent of the subretinal fluid into the lower half of the eyeball, provided this portion was still free.

Twenty cases (1–20) were treated by simple puncture; 6 showed marked improvement while 1 was cured (Case No. 13,

watched two and half years). Three bad results followed—hemorrhage into the vitreous—while eight remained unchanged—that is, followed the usual course of retinal detachment and became eventually blind.

From a percentage standpoint, the results would seem to be wonderfully satisfactory; but the statistics become reversed when we include the cases where simple puncture was unavailing and recourse had to be made to more severe operative procedures; but it may be said that simple puncture seldom causes harm, frequently causes a slight improvement, and only exceptionally results in a reattachment; partial reattachment following puncture is usually only temporary. The only frequent complication following puncture is the one that is encountered so often in punctures of all sorts—vitreous hemorrhage. But that this is not always followed by deleterious results is shown by Case No. 28.

Only in occasional cases does vitreous hemorrhage immediately follow the operation. As a rule, the patients give the history that the vitreous hemorrhage appears 2–5 days after the operation even in eyes with normal tension. The patient declares that the eye became suddenly blind, accompanied by slight pain, although on that day vision was still existent. We have to rely upon these statements as the patients invariably lie or sit in bed following operation, and are not examined ophthalmoscopically for at least a week.

I could not convince myself of the value of a pressure bandage, either alone or following operation. It was to be expected that vitreous hemorrhage would be prevented by the bandage, but this did not prove so. Consequently, during the later years, I have avoided the use of a pressure bandage following operation for retinal detachment, all the more in that unpleasant folds in the cornea frequently appear in the hypotonic eye.

Even in cases where no vitreous hemorrhage appeared, the puncture was almost invariably followed by a marked increase in the vitreous opacities. These, as well as the hemorrhage, were usually beneficially influenced by subconjunctival injections.

It seemed of great importance to me to attempt to find the cause of the reattachment in those few cured cases, but my

attempts were unavailing. It did not seem that the adhesion between the retina and chorioid at the site of puncture, which later became visible ophthalmoscopically, had any marked influence upon the farther course, for in many cases I saw the retina, previously intact, reattached at the site of puncture and detached in surrounding areas. It is more likely that the beneficial effect of puncture is simply the removal of the subretinal fluid, whose destructive influence is not negligible, and thereby allowing an easier resorption of the remainder.

Consequently, I did not deem it advisable to perforate the retina, especially in those cases where no perforation existed. This was the reason that I discarded the Deutschmann puncture, which I used ten times during the period under discussion and from which I obtained no better results than from simple puncture.

2. Puncture and Cautery.

I attempted puncture with cautery by two different methods. The first was that highly recommended by Dor (1), although I varied his technique in that I used the galvanocautery, instead of the hot iron. The conjunctiva was freed at the site of operation over a large area and immediately after the puncture the surrounding sclera was cauterized. After a few cases, I discarded Dor's method of repeated cautery through the conjunctiva because of subsequent adhesions, but even more because of my skepticism regarding his claim of the formation of adhesions between the chorioid and retina.

On the other hand, I have practiced extensive cautery immediately after puncture. I was led to this by the writings of L. Müller (1) who believed that a decrease in the extent of the scleral surface would simplify the reattachment of the retina. Therefore, by extensive cautery, I endeavored to reduce the size of the sclera.

The bulbar conjunctiva was extensively incised—either concentric to the limbus or radially. A Rectus (lateral or inferior) was detached and then an equatorial puncture was made. Immediately thereon, a wire or Paquelin at low red heat was used to cauterize the sclera over an area 10–20*mm* long to 5–10*mm* wide, so that the shrinkage compensated for the loss of tension of the eye caused by the discharge of the subretinal fluid.

I performed puncture and cautery 42 times on 30 eyes of 27 patients.

Only ten eyes were treated alone by puncture and cautery, and of this number one has remained cured for six years (Case No. 28). In four eyes, temporary improvement could be noted, and in the rest no change. In three, the symptoms were markedly aggravated, among them two vitreous hemorrhages. The majority of these cases were operated upon by ordinary methods subsequent to the failure of this type.

Case No. 28, the one healed case, was a detachment following recurrent iritis due to diabetes; the other eye was blind from a previous detachment.

It is scarcely necessary to emphasize that cure of a retinal detachment is not identical with restoration of function. As a rule, the detached portion loses its function and the remainder of the retina is functionally somewhat damaged.

Based upon these observations, I have been impressed that extensive cauterization as well as punctate cauterization exercises no marked change beyond that obtained from simple puncture. At any rate, I could not convince myself that adhesive inflammation of the chorioid followed cautery, if indeed it played any rôle in the reattachment of the retina. Moreover as this procedure is very painful, I abandoned it.

3. Scleral Excision of L. Müller (Cases 37–49).

I performed sc'eral excision, according to Müller's original description (1), on eight eyes (2[1]). Seven were myopic to a high degree, and one nearly emmetropic (exact refraction impossible to determine because of nuclear cataract). In two eyes, extraction was performed; six of these cases showed marked improvement, but only two of them appeared to be permanent. In one of the two, there was a complete reattachment observed for several years. In only one case was the detachment fresh (four weeks old), although the vision had dropped to only hand movements (Case No. 49); in two cases, the condition had existed for four months; in another, six months, and in another, ten months; while the rest varied up to five years.

[1] Again this year on three eyes. In one of them, a reattachment occurred in ten days and remained during the period of observation, three months (detached for seven weeks).

In only three eyes was the scleral excision performed as a primary operation. In three cases it was preceded by a simple puncture, in another case three punctures with cauterization, and in another puncture and Deutschmann section.

In the case where it had existed four months, no improvement could be seen, but there appeared a complete separation of the retina on one side at the ora. In this case, a preliminary puncture was unavailing (Case No. 48); the second case that showed no improvement (45) was also preceded by a futile puncture. Here the second eye was blind from detachment and cyclitic cataract. I have already mentioned the fact that the poor result in the primarily blinded eye led to a poor prognosis for the second. In none of the cases was the other eye normal. In three there was a high myopia with a chorioiditis and a maximum corrected vision of 0.3. In three others, there was detachment and cyclitic cataract (one enucleated); and in two, the second eye had been damaged to a severe degree by previous detachment. With these factors in mind, we must consider a slight and not always permanent improvement in six out of eight eyes operated by scleral excision, an unexpectedly good result.

But the results were not so good in the eight cases upon which I attempted a modification of the Müller operation. I was led to attempt this modification by the following facts: the Müller scleral excision absolutely demands complete narcosis, because of the necessary invasion of bony tissues, and only in deep narcosis is the Bell phenomenon lacking (probably also in scopolamine—Twilight Sleep with light narcosis—but this anæsthesia was not known at that time). Therefore the patient had to be deeply under the influence of the anæsthesia in order to keep the eye easily in the median position. My modification could be practiced under local anæsthesia. The excision (meaning thereby, the suture) is easier the thicker the sclera is. Myopic eyes, which form the majority of cases for this operation, practically always have a thin sclera in the equatorial region; whereas the anterior portions of the sclera, especially in the neighborhood of the insertions of the Recti, are usually of normal thickness. Another factor that renders the operation easier is the thickness of the uvea, thereby avoiding the not infrequent com-

plication of rupture of the chorioid, alone or with retina. All these factors led me to make the incision in the anterior segment of the eye, making the anterior incision 2–3*mm* in front of and the posterior 5–8*mm* behind the insertion of the external Rectus. This brings the operation in the area of the detachment. In one case (No. 37) upon which a Müller had already been performed, there entered one other factor which seemed to me to be of importance, viz., the desire to perform the excision in the immediate area of the detachment. For, if the lower half of the retina is detached, while the upper half remains in place, it would seem rational to perform the excision in the lower half of the eye; but my results have not proven this contention.

I operated upon seven eyes in six cases (six of the seven were myopic) by my modification and obtained a marked improvement in five. Among them was Case No. 37 in which the Müller–Elschnig had been preceded by an original Müller. One of them had been punctured three times without visual improvement; in one, vision was improved from finger counting at half meter to fingers at six meters. In this case, a puncture was performed later which resulted in a complete detachment of the retina. We observed another case for two years during which time vision rose from practical amaurosis to finger counting at one meter (Case No. 42). The patient was practically emmetropic and the disease had existed for nearly a year.

In two cases, the eye became worse; in one, there had been a preceding puncture. The disease had existed only a short time in both of them. The second eye of one case had been suffering from detachment of the retina for nearly five years and had been operated upon according to the original Müller procedure. The expectations which led me to the modification did not completely materialize; the chorioid in the ora region is not always sufficiently resistant, especially in cases of detachment of the retina, to bear the vitreous pressure. (This is probably increased by grasping the sclera with instruments; for I had in one case, a rupture of the chorioid with loss of vitreous.) But of more importance is the fact that never did an iridocyclitic follow an original Müller, while, with my modification, I had two cases of marked plastic iridocyclitis, Nos. 40 and 44. These were certainly not infections, for the

customary preliminary examination of the conjunctival sac proved it to be sterile.

It was rather noticeable that here, as in untreated detachment of the retina, the tension remained somewhat subnormal for a considerable period of time. Only once did I observe the phenomena I previously described—sudden deepening of the anterior chamber and marked tremulousness of the iris and lens (Case No. 44). In every case, the anterior excision produced a more complete anæsthesia of the cornea than did the Müller, but I never observed any subsequent injury that amounted to anything. Once, a temporary "thread keratitis" followed an original Müller (Case No. 49), but epithelial changes are prone to follow operative procedures on prominent myopic eyes, and it is very possible that the cornea was not sufficiently guarded during the course of operation.

My operation resulted in much more marked deformation of the bulb. The original Müller caused a marked change in the radius of curvature of the cornea, but nothing like the high degree of astigmatism resulting from an anterior scleral excision. I am unable to give exact figures, for the poor central fixation forbade exact measurements. The angle gamma was usually doubled by either of the operations and became equal to 10–13 degrees. This resulted in an apparent marked strabismus. There was one other cosmetic disfigurement and this was the apparent enophthalmus.

These observations led me to discard my modification in favor of the original Müller equatorial scleral resection.

In the first cases, I preceded the operation, according to Müller's instructions, by a Krönlein resection of the lateral wall of the orbit, but as Czermak (1) has shown, the scleral excision may be done without this preliminary step, provided the bulb is prominent. Among the later cases, even with sufficient prominence of the eyeball, I performed a definite resection of the protruding edge of the lateral wall of the orbit by means of the Lüer forceps or the electric-driven burr, after the periosteum had been freely dissected away. This procedure is simpler than the Krönlein, and the field of operation is more freely exposed, for the skin-and-bone flap is not constantly intruding itself. After the scleral excision is finished, the periosteum and the skin wound are sutured and not the

slightest deformity follows the primary union. An equatorial scleral flap 25*mm* long and 8–10*mm* wide seems to yield the best results. Following Müller's advice, I had been in the habit of preceding the resection with two or three sutures. I excise the flap about 2*mm* at a time, preceding the excision by a suture, inserted at the point where the excision stops. This is tied as soon as the sclera is cut through, and the gap intervening between this and the preceding sutures is closed by other sutures as rapidly as possible. Thus the premature rupture of the chorioid is hindered.

In cases in which a puncture has preceded the operation, the chorioid is apt to be adherent to the sclera, and, unless this adhesion is carefully freed, an untoward tear of the chorioid may occur easily.

In several cases, there was a passing disturbance of motility, occasioned by paresis of the external Rectus. A fixation of the externus onto the lateral orbital wall occurred in two cases, although great care was taken to keep the muscle and periosteum separate.

I was able to draw the following conclusions from my observations of excision of the sclera in retinal detachments: the operation is practically without danger; small excisions because of the shorter period of operation and because of the lesser damage to the uvea in the operated field seem to yield more favorable results than the extensive ones.

A skilled operator with skilled assistants should be able to perform the operation in thirty-five to forty minutes, in cases of thin individuals with an orbit fairly free from fat.

4. Puncture with Vitreous Injection.

Theoretical considerations similar to those that directed the experiments of Deutschmann, as well as practical experience that I had had before the beginning of these investigations, led me to the combined therapy of retinal detachments.

It was easily conceivable that the beneficial effect of the removal of the subretinal fluid was restricted by the enormous hypotonicity and the resultant vitreous hemorrhages; therefore, I first tried pressure bandage after puncture and then subsequent extensive cauterization, in order to cause a return of normal tonicity, as Müller attempted by his scleral excision.

As all of these attempts came to naught, I passed on to a

vitreous injection. In addition to the above mentioned viewpoints, there were two further considerations that urged me on. First, a permanent reattachment should be easier to bring about by increasing the vitreous pressure, *i.e.*, the vitreous volume, as has been repeatedly done (see literature). Second, that in those cases, with limited communication with the vitreous chamber and the subretinal spaces, osmotic processes between the fluids of these spaces could lead to an increase of the detachment. (This is in accordance with the Rahlmann theory.) This idea received a firm support from one of the earlier cases (28) in which a permanent reattachment followed a single puncture, as a result of an extensive hemorrhage into the vitreous.

On the 12th of February, 1908, I followed the usual puncture of a retinal detachment with injection into the vitreous of 1*cc* of autogenous blood serum. The subsequent dense opacity of the vitreous was expected, *a priori*. After further experiences with this procedure of vitreous replacement (9), I attempted it in other cases of retinal attachment. For this purpose, I operated upon six eyes with extremely dense vitreous opacities or hemorrhages. In some, I used a salt solution of hypertonic strength (up to 0.95). In regard to the vitreous replacement, results seemed to be good; but the detachment, as far as it could be determined because of the dense opacities, did not seem to be markedly influenced. As these cases present nothing interesting, I shall not publish them in detail; nor a case of detachment following perforating injury that was completely cured by a single vitreous injection. This latter can be found in my work on Vitreous Replacement (9).

From the 30th of June, 1909, on, I combined the puncture with an injection of 1*cc*, or less, of physiological salt solution into the vitreous in three cases. The salt solution was introduced into the vitreous through a cannula that entered laterally in the region of the ora, simultaneously with, or immediately after, the incision of the sclera and chorioid with a cataract knife or keratome. After the appearance of Birch-Hirschfeld's publication (10), I adopted his procedure, but only once did I follow his advice of injecting a solution of nine parts of normal salt with one part of subretinal fluid. Iritis with hypopyon was the result in No. 55.

In two cases (Nos. 37 and 58) I mixed the fluid for injection with autogenous serum in the proportion of 10–1, in order to attain as nearly as possible the normal constituency of the vitreous, but denser opacities resulted from this than from the use of albumen free fluids.

In several cases I used Tyrod's fluid,[1] but this does not appear to have any advantages over the normal salt solution; moreover the red color is slightly disturbing.

I did not attempt the injection of sterile air into the vitreous, for the use of normal salt seemed more rational. In my work on replacement of the vitreous (9), I objected to the use of more than 0.5 to 0.6*cc* as severe iritic disturbances could easily follow; but I believe that these can be completely eliminated by making the solution of ***freshly distilled water*** analogous to the elimination of fever after an intravenous Salvarsan injection. Still the use of 1 or ½*cc* fluid is not negligible, but we must also consider the fact that iritis can appear after any operative procedure, even simple puncture, and frequently appears spontaneously during the course of an untreated retinal detachment. Birch-Hirschfeld (10) maintained that the subretinal fluid should be withdrawn as completely as possible under ophthalmoscopic control, even in cases where no visible perforation of the retina is present—as much as 3*cc* of fluid could be withdrawn without reattachment. I did not attempt ophthalmoscopic examination during the operation because of the extreme optical axis necessary for an equatorial puncture. On the other hand, the position of the cannula in the vitreous can be watched in every case by the operator or by assistants with the aid of an electrical head-lamp.

In the operation as proposed by Birch-Hirschfeld, it is not always possible to perforate the retina after withdrawal of the subretina fluid, even if incomplete. In these cases, a second cannula had to be forced into the vitreous through another portion of the ora region, in order to make the injection possible. During this procedure, I once injured the lens; consequently in the later cases, I inserted two needles simultaneously, although in different locations—one to withdraw the fluid and the other to inject into the vitreous.

I do not believe that the collapse of the eyeball, consequent

[1] Neukirch, *Arch. f. d. ges. Physiologie*, vol. cxlvii., 1912.

upon withdrawal of a large amount of fluid, and the subsequent necessity of injection of an equally large amount of fluid, is of negligible importance to the integrity of the diseased eye. Consequently, I agree with the opinion that Birch-Hirschfeld expressed at the last Heidelberg Congress (1913), that not more than 1–1½*cc* of the subretinal fluid should be withdrawn.

In the one case (No. 63), the resultant cataract must be ascribed to the technique and not to the type of operation. In one further case (No. 56), the eye was lost by a saprophytic infection, despite the strictest aseptic precautions. The unsatisfactory results in the other cases must be ascribed to the abnormally large amounts of fluid evacuated and injected.

This procedure was carried out on twenty-two eyes of nineteen patients; in one eye, twice, and in two eyes, three times; twenty-six times in all. Among these cases, the detachment was due to trauma in two, following extraction with vitreous prolapse (No. 55), one; once after recurrent iritis (No. 54 myopia); once after keratitis parenchymatosa; and once in a myopic eye following extraction and discission performed at another clinic (No. 60). In this last case, a puncture of the primarily diseased eye resulted in a complete loss of vision. Of the remaining thirteen eyes, six were myopic and seven practically emmetropic.

In six cases, other operations, aimed at the retinal detachment, had been practiced.

Seven eyes, in five cases, were improved (four highly myopic, one slightly myopic, and two emmetropic). The slightly myopic eye (No. 57) was observed seven months and retained a visual acuity of 0.2. In five cases, the improvement was slight, but only temporary (two myopic and three emmetropic). In ten eyes, the deterioration continued. Among those were detachments following extraction of traumatic cataract, following keratitis parenchymatosa, and following recurrent iritis. The poor results—two cases—were due, not to the method, but to the technique (No. 63, traumatic cataract and No. 56, saprophytic infection). Of the seven remaining poor results, two eyes were emmetropic, four highly and one slightly myopic.

In seven of the cases, the cause of the poor result was a vitreous hemorrhage, and in all of them, large amounts of fluid

were withdrawn. In one case, the detachment was in the upper half. In one case, there had been three preceding punctures and cauterization, and in one, only one puncture.

In none of the cases was there a complete reattachment of the retina.

Although my material is too small and partially useless in that I followed Birch-Hirschfeld's directions in too many cases of withdrawing too much fluid, still I believe that I am justified in assuming that puncture, with simultaneous injection into the vitreous, will prove a valuable addition to our armamentarium. But I do not believe that greater statistics will fulfill the hopes aroused by wonderful results published by Birch-Hirschfeld.

I would summarize my observations as follows: Operative treatment is indicated in all cases of detachment of the retina that do not yield to conservative treatment within six weeks. As a possible exception to the time limit might be mentioned those cases wherein iritic irritation appears a short time after the detachment has occurred. But I do not include the cases of detachment following an old iritis.

The operative procedures that come under consideration are: scleral puncture with injection into the vitreous; and the Müller scleral excision. The less severe procedure should be attempted first, and, if unsuccessful, should be repeated without too great an interval of time intervening. If still unsuccessful, the scleral excision should be carried out. Only in those cases in which large tears in the retina are visible should a primary scleral excision be attempted. Operative interferences should not be undertaken too close together; at least six weeks should intervene. Post-operative irritations of the iris or opacities of the lens should be blamed upon the technique—not upon the method.

Iron-bound operative indications and prognoses cannot be established, however, until the causes of detachment of the retina are absolutely confirmed.[1]

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[1] Owing to lack of space, the report of the cases will be omitted. For these details, the reader is referred to the original publication.

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A METHOD OF PRESERVING MACROSCOPIC EYE SPECIMENS IN THEIR NATURAL COLORS.

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WE often wish to preserve macroscopic specimens of eyes. A number of methods have been suggested. Preservation in Müller's fluid or in alcohol has been abandoned because the tissues change in color, the colors are entirely lost, and nothing remains but the contours.

An excellent method is the one devised by Priestley Smith (*Ophthalmic Review*, March, 1883). This consists in the use of gelatine. An eyeball which has been preserved in alcohol is divided. One half can be used for microscopic examination, the other is subjected to a 10, 25, and 50% solution of glycerine for one day each. This prevents contraction when the specimen finally comes into the gelatine. The eye is preserved in a specially constructed little glass vessel which is filled with fluid gelatine. No air bubbles should be admitted and the specimen is held in contact with the glass bottom of the little jar until the gelatine has become hard. The jar is then closed by glueing on a plate of glass. Instead of a flat bottom to the glass jar, the glass has been ground to a plano-convex shape which magnifies the specimen and is the method now in use at Moorfields Hospital.

The disadvantages of this method consist in that the colors are not preserved and in the course of years the gelatine becomes fluid and the specimens are spoiled. Nettleship made a slight modification which did not entirely remove these objections.

Another excellent method is the dry method. The eyeballs

are fixed according to any method and then hardened in alcohol, divided according to the desired shape, then placed in absolute alcohol which is changed until the specimen is water-free. Then it is placed in pure turpentine oil for eight days until the specimen becomes transparent. The specimen is then placed in a bowl which is partly covered and the turpentine is allowed to evaporate slowly, until the specimen is quite dry. It is then placed in a glass jar to protect it from dust. It is very difficult to prevent subsequent shrinkage and the method is suitable only for a few specimens.

Hardening in formalin has certain advantages, as in this agent the cornea remains transparent, but the lens clouds. I made use of formalin and suggested a method in 1898 which is published in my book on *The Microscopic Examination of the Eyeball.* The method consists in placing the eyeballs in small flat jars. The eyeball is hardened and then divided anteroposteriorly. It is then placed for a few minutes in distilled water. The specimen is then attached to the inner wall of the glass receptacle with some warm eating gelatine. After from one to two minutes when the glue has become stiff the vessel is filled with alcohol or formalin solution. The top of the glass is then fastened to the upper edge of the glass jar with warm rubber adhesive material and care must be taken that no air collects. On the top of the glass jar we place the label of the specimen.

This method has found favor and has seemed serviceable. Most colors are preserved, especially the tapetum in the choroid of some animal eyes. The bright iridescent color remains for years. Unfortunately, blood pigment is not preserved and many specimens present a different appearance from that which is natural.

The Kaiserling fluid has the property of preserving the color in blood tissues. A new epoch began in a number of pathological museums from the day of the use of this method. It has been used to preserve eye sections as follows: The eyeball is first placed in solution 1:

500 distilled water
100 formalin
10 acetate of potash
5 nitrate of potash

for twenty-four hours. Generally there is a decided shrinkage. It is therefore well before placing the specimen in this solution to inject some of the solution into the vitreous chamber. After twenty-four hours the eyeball is divided with a broad knife, the vitreous is carefully removed with a small brush, care being taken not to injure the retina. The eyeball is then placed in 70, 80, and 90% of alcohol for ten minutes each. It then comes into the final solution, the Kaiserling preserving fluid, which consists of:

1000 distilled water
100 acetate of potash
100 glycerine.

This method preserves the important blood pigment. The normal eye-ground has an entirely different appearance: the vessels of the retina are red and the choroid pinkish. A retinal hemorrhage or the hæmophthalmus preserve their color beautifully. Unfortunately experience has shown that this method is not very serviceable, for it seems difficult to keep the eyeballs from shrinking, and much valuable material has been lost. I have therefore abandoned this method entirely and prefer Pick's solution, which also preserves the blood pigment. The eyeballs are first placed in the following solution: artificial Carlsbad salts 50; distilled water 1000; formalin 50. In this solution the eyeballs remain for from twelve to twenty-four hours. It is advisable to inject some of the fluid into the vitreous chamber. The eyeball is then divided and the half to be used for macroscopic purposes is placed in 70 and then 80% alcohol for ten minutes and finally in 96% alcohol for a half hour. The eyeball at last is placed in Pick's preserving fluid:

500 distilled water
150 sodium acetate
250 glycerine.

Recently the following modification has seemed the best to me. The eyeball is hardened for from twelve to twenty-four hours in 5% formalin solution. Then it is divided and placed in alcohol. The formalin causes a certain amount of the

coloring material to be lost. If it remains in this solution not longer than twenty-four hours, the color can be obtained again when the specimen is placed in alcohol. The eyeball is then placed for ten minutes in 70 then 80% alcohol, and finally for half an hour in 96% alcohol, and then in Pick's preserving fluid.

Before placing it in this solution, the specimen should be glued fast in a suitable glass jar. The back surface of the eyeball is placed for a few minutes in distilled water. This is the surface which is to become glued. It is then carefully dried. A little eating gelatine is dissolved in a glass and the specimen is glued by means of this to the glass wall or to a milk glass plate on which the eyeball is to rest. Instead of gelatine, we may use warmed Kronig's material. After a minute or two the specimen is usually dry. The vessel is then filled with a preserving fluid and the margin of the glass and the top are stuck together with the adhesive mixture. Care must be taken that no air is admitted.

I wish to state in conclusion that the experimentation with these various methods was to a great extent the work of my laboratory servant, Wittke, and that the favorable results are to a great extent due to him.

DEPARTMENT ON CONSERVATION OF VISION.

By Dr. GEORGE S. DERBY and Mr. HENRY COPLEY GREENE, Boston.

PUBLIC School Classes for Children with seriously defective eyesight offer a hopeful opportunity to oculists and lay workers for the conservation of vision. Such classes have been successfully started in Mülhausen and Strassburg in Germany; Birmingham and London, England; and Cleveland, Milwaukee, and Boston in the United States. In New York and Chicago the public school classes for blind children have included a few pupils not blind but with very low vision; and the comprehensive development of these classes, so as to provide for all New York public school children with seriously defective sight, was planned by the late Gertrude E. Brigham, Inspector of Classes for Blind Children in that city.

The standards of vision in the classes about which we have secured definite data on this subject are as follows:

	No. of Pupils.	Standard of Vision with Glasses.
London[1]	313	$\frac{6}{18}$ to $\frac{6}{24}$; 5 D. to 15 D. Myopia.
Cleveland	28	$\frac{6}{18}$ to $\frac{6}{60}$.
Strassburg	21	Less than $\frac{20}{100}$.
Boston	17	$\frac{20}{70}$ or less, with exceptions up to $\frac{20}{40}$.
Chicago		"Nothing like $\frac{20}{70}$," *i. e.*, much lower.

The causes of visual defect among children are of interest especially in their bearing on methods of teaching. For

[1] "The Education of High Myopes," by N. Bishop Harmon, F.R.C.S., the *Braille Review*, September, 1913. This report covers the period from the foundation of the experimental class in 1907 to the end of 1912. In August, 1913, there were three classes in London with total accommodations for 103.

example, where myopia preponderates, the pupils' capacity for distinct vision at very short distances must be considered, while the children's inability to see distinctly, even at the shortest distances, must be considered in classes, like that at Strassburg, where opacities of the cornea preponderate. The types of cases in London, Cleveland, Strassburg, and Boston may be compared, in approximate percentages, as follows:

	Per cent. Due to Each Cause.			
	London.	Cleveland.	Strassburg.	Boston.
Total Cases	313	28	21	17
Congenital Cataract	1.9	25.	28.	12.
Other Congenital Disease or Defect	4.2	4.	19.	6.
Interstitial Keratitis	7.7			24.
Ophthalmia Neonatorum and Purulent Conjunctivitis	4.2			
Superficial Keratitis	16.0			
Corneal Opacities		18.	43.	12.
Choroiditis and Iridocyclitis	2.6	7.		
Myopia	62.7	18.	10.	24.
Hypermetropia	.1	7.		6.
Miscellaneous	.6	21.		16.

Salient features of the London classes are: (1) that the pupils are not taught Braille; (2) that they are not allowed to read ordinary books, special large type sheets being substituted; (3) that knitting, if held near the eye, and needlework are prohibited; (4) that writing, arithmetic, reading, and a few manual occupations are taught in the "Myope Classes," and that (5) the pupils attend the regular public school classes for all oral lessons, drill, singing, wood-working, cooking, and laundry work.

The Boston School Committee opened its Defective Eyesight Class with five pupils in April, 1913. A teacher of proved capacity and resourcefulness prepared herself, among other ways, by making fonts of heavy black letters gummed on to individual cards, and large maps having coarse outlines and states or countries in color. She collected numerous appliances and materials, desk looms, spool knitters, wooden knitting

needles, wool, reed, cane, etc.; for her appeal was to be through the eye and hand as well as through the ear. The teaching is necessarily individual. Each child is dealt with according to his defect and advancement. Superintendent of Schools Dyer says of this class in his annual report for 1913: "The progress made by the children, to whom school had meant almost nothing, has been remarkable." In the first full term, during the next winter, the class had seventeen pupils. In its third season, it now has eighteen; and preparations are on foot for the opening of a second class. Meantime an important early lack has been filled by Dr. Elwood T. Easton's regular supervision of the pupils' ocular condition.

The following address,[1] by Dr. E. Redslob, translated with some abbreviations from the original German, shows the methods and purposes of his admirable class in Strassburg.

SCHOOLS FOR CHILDREN WITH DEFECTIVE EYESIGHT.

(By Dr. E. REDSLOB, Oculist.)

Side by side with the growing demands which school training makes upon our children, has grown the care for their physical welfare. In most cities school physicians have been installed and almost every large city has its school oculist. I should like to make you acquainted to-day with a new social institution which has been maintained for three years in Strassburg. This is a ***public school class for children with defective eyesight.***[2]

How did the need arise for establishing such a school? Pedagogical and hygienic considerations both came into play here. In public school classes, the teacher cannot give special attention to the cases with seriously defective vision. Such children,

[1] "Ueber Schulen für Schwachsichtige," *Strassburger medizinischen Zeitung*, 1 Heft, 1914.

[2] In the discussion of this address Privy Councillor Professor Axenfeld of Freiburg asked whether this school were a benevolent institution. Here in Strassburg the School for Children with Defective Vision is a city school. It is part of the public school system, and is under the supervision of the circuit school inspector. The teacher was taken from the middle (intermediate) school. In order to be effective the school must stand on a strong footing. This is the case only when the community is responsible for the administration and the running expenses.

therefore, have the greatest difficulty in keeping up. From the standpoint of medical hygiene, moreover, it is extremely desirable that children with defective vision should spare their weak or diseased eyes as much as possible.

What children are included in the class of visual defectives? To be successful, the number of pupils per class should be limited. The teacher must know each of his pupils; he must proceed on strictly individual lines, according to the grade of visual defect and of mental capacity. This is the prime requisite.

What children are to be picked out of the mass as visual defectives? Defective vision is a very vague concept. The same degree of defect, scientifically speaking, does not determine equal degrees of handicap in different children. Many people can turn their remnant of visual power to much better account than others. Intelligence and a certain inborn skillfulness come into play. Although I was well aware of this, it was necessary in the beginning to proceed on a strictly numerical basis. It was therefore decided to admit only children in whom the corrected vision of the better eye was less than $\frac{20}{100}$.

It was found that out of the 21,000 public school children of Strassburg about twenty fulfilled these conditions—that is, about $\frac{1}{10}\%$. Two, however, were very weak mentally, so that they were placed in the special class (for mental defectives). For if children with defective eyesight are further afflicted with feeble-mindedness, the mental defect above all else must be taken into account in their training.

In the course of time children were added whose vision somewhat exceeded $\frac{20}{100}$, when their teachers certified that progress was prevented by their poor eyesight. The class now also takes in children who have somewhat better vision, but are suffering from recurrent inflammation of the eyes. Thus in the course of time, the number of pupils in the Class for Children with Defective Eyesight rose to twenty-two. To admit more children to one class would defeat its purpose.

What eye-diseases lie at the basis of the visual defects of such children?

In nine children there was found corneal opacity following scrofulous ophthalmia.

In two children, high myopia.

In four children, cataract (part operated, part inoperable).

In one child, dislocated lenses.

In one, congenital aniridia, with cataract.

In four children, nystagmus and congenital amblyopia.

Corneal opacity and congenital defects, therefore, play the chief part in the extreme defects of vision of school children.

How is this Class for Children with Defective Eyesight conducted?

At present it still consists of a single class, where children of all ages from six to fourteen are taught by one teacher. The instruction is not according to the usual plans for teaching normal children. Since their remnant of vision should not be greatly taxed, it is much more difficult to impart sensory concepts to them. In all the school exercises the teacher seeks to work more upon the ear than the eye; and the other senses (touch and smell) are also called into play as actively as possible.

Writing is of course indispensable, but reduced to a minimum. The question whether slanting or upright writing shall be used is less important here than in classes for normal children. The significant thing is not in what style, but how long they write. Accordingly they never write for longer than ten or fifteen minutes at a time. I have tried to simplify the writing in the copy-books by introducing new books. These differ from the usual copy-books in having a wider space between the lines and in a greater distinctness in the ruling—broad black lines on white paper. According to the reports of the teacher they seem to work very well. In the first place, the children like much better to write in the new books than in the old ones. The children write more rapidly in the new books and read the writing more easily. Exact measurements show also that the head is not held so low in writing in the new books as in the old. The difference amounts to about two or three centimeters. That seems very little at the first glance; but when we consider that children with a high degree of eye-defect write with their eyes about seven to ten centimeters from the paper, an increase of two or three centimeters certainly amounts to something.

The children write a good deal with chalk on the blackboard. Writing on the blackboard has the advantage of being much

larger and much easier to read. The plane of the blackboard should not, however, be parallel with the wall. It ought rather to slant, as can easily be arranged by a special contrivance. For in writing, as in reading, at a short distance, the eyes should be directed downwards; and this is not the case when a vertical blackboard is used. Investigations, the most recent of which are those of Dransart, have shown that in looking above or in the plane of the middle of the eye the angle of convergence is much smaller than in looking downward. In looking upward or straight forward in reading or writing, therefore, the eye muscles are much more quickly tired.

In order to make *reading* as easy as possible, nothing is read until the subject-matter has been already gone over and developed orally. We are preparing special reading books with large clear print and simple illustrations consisting only of the essential lines.

Drawing is done with charcoal on white drawing-paper; never with pencil; the slate, too, is very seldom used. In order to impress upon the children the form of a given object, it is drawn or modeled. Only objects with lines and surfaces which can be simply represented are used as models. In *geography* map-reading is put somewhat in the background. To illustrate surface forms, sand and clay relief maps are made.

The teaching in *natural history* and plant-study is given as far as possible out-of-doors. The children go often during schooltime for walks in the suburbs; and the teaching is related to the objects which nature presents to them. This out-of-door teaching benefits not only the eyes but the whole physical constitution. And we must not neglect this. Half of these children are afflicted with scrofulous diseases. It is owing to this circumstance that 50% of the children receive free milk from the city. In order to make attendance at the school easy, street-car passes also are distributed by the city. Home lessons are never assigned in winter, seldom in summer; for the homes of these children are often wretchedly lighted.

In the Class for Children with Defective Eyesight we are aiming not only at hygienic but social welfare. Since we cannot know whether in the future this child or that will be totally deprived of sight, we must make the pupils familiar with work by which they can earn their livelihood later. The children

are therefore first of all thoroughly trained in basketry and net-making; later are to come brushmaking and the other trades taught in the institutions for the blind. The objection may perhaps be raised that children with defective eyesight will overtax their eyes in learning handcrafts. This danger exists, however, only at first. The children are therefore told to be very careful at the beginning of the lessons in basketry. Soon, however, the work becomes purely mechanical. When the children have once mastered their work, they turn away their eyes spontaneously, or are encouraged to do so.

The school has further set itself the task of finding suitable places for the pupils when they leave, so that they may earn their bread without danger to their eyes.

I have tried to tell you, in the barest outline, of the principles upon which the teaching in the Class for Children with Defective Eyesight is founded. As far as accomplished results are concerned, we may be well satisfied. Although we cannot expect decorative penmanship of the pupils, they do learn to write and to write properly. They read and compute quickly and correctly, and when they leave the School they have reached at least the same grade as the children in the regular classes. Meanwhile their weak eyes have been spared as far as possible. One mother said of her own accord that her little daughter (M. S.) had never learned to write in the regular school, although she was not at all stupid. Since she has gone to the Class for Children with Defective Eyesight the child has done so well in a short time that she writes better than her elder brother with normal vision, who goes to the regular public school.

Such public classes for children with defective sight are as yet to be found, in Germany, only in Strassburg and in Mülhausen, where my colleague, Dr. Weinberger, in his time was so good as to make me acquainted with the arrangements. Since these schools are an entirely new institution, we cannot expect them to reach the highest degree of perfection at the outset. We must gain more experience and make more progress in the education of our visually defective school-children.[1]

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[1] In the discussion, Dr. Zade of Heidelberg suggested that the modern optical devices, the double-verant and telescopic magnifier of the firm of

The results already achieved permit us, however, to say that every one of the larger cities should have such a school for visual defectives.

Zeiss, might be employed in the teaching of children with defective vision. This suggestion will be followed to the best of our ability. I believe if the question of expense does not make it impossible we shall obtain good results with these magnifiers.

REPORT OF THE MEETING OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By GEORGE H. BELL, M.D., Secretary.

H. H. TYSON, M.D., CHAIRMAN. MONDAY EVENING, NOVEMBER 16, 1914.

Dr. A. NETTLE presented a case of **glioma of the orbit** in a child two years of age. On August 4th, the eye was removed for glioma of the retina. Six weeks later, the process had extended to the optic nerve and had involved the orbit. When presented before the Section, the mass filled the orbit and had pushed the eyelids out so far that they were very tense and swollen. The child was under X-ray treatment.

Dr. THOMSON said that he had seen Dr. Nettle's case after the enucleation, and found that the glioma had extended back into the optic nerve. It was a case of the direct extension of the disease.

Dr. E. F. KRUG presented a case of **retinitis proliferans,** in a man, and gave the following history: J. A. D., age 50, has been under observation at the New York Eye and Ear Infirmary since August 12th, with a history of not having seen well with the right eye for over a year. Since June, the vision in the left eye has been failing rapidly. Patient has chronic nephritis; albumin, hyalin, and other casts; low specific gravity; blood pressure varying between 185 and 200. Is under treatment by his family physician for his nephritis.

Right eye: Hemorrhagic neuroretinitis. S. $\frac{20}{200}$.

Left eye: Vitreous full of cholesterin crystals, some very large; retinal hemorrhages everywhere; from the disk, a fan-shaped proliferation of connective-tissue bands and tortuous blood-vessels extends into the vitreous in all directions, with

only small areas of clear vitreous between—the typical picture of retinitis proliferans.

Since first seen, there has been very little change in the fundus picture of this eye. The right eye has been growing progressively worse; larger hemorrhages and new connective-tissue bands and new blood-vessels are beginning to extend from the nerve head into the vitreous. The sight in this eye is now only $\frac{10}{200}$; the sight in the left eye has remained about the same, $\frac{5}{200}$. There has been some improvement in the kidney condition, and the blood pressure has been reduced to 185.

Dr. JOHN M. WHEELER presented a patient with **cystic tumor in the hypophyseal region.**

Frank C., Italian bricklayer, age 38, and married. Patient is the father of five children, three of whom are alive and well. One died at two months, and one at six months.

About two and a half years ago, the patient first noticed indistinctness of vision in the left eye. About the same time he noticed a slight protrusion of the left eyeball. No pain or headache until about three months ago, when there were severe frontal and occipital pains, lasting for two weeks. At the end of this period, patient had a day and a night of vomiting, without nausea. Has not vomited since and never has had nausea or dizziness. Mercury and potassium iodide have been administered for several months without improvement of exophthalmos or vision.

October 9th. Vision: O. D., $\frac{20}{200}$; O. S., light perception (faint). Pupils react to light both directly and consensually. Left pupillary reaction, sluggish. Exophthalmos: O. D., 18*mm* O. S., 22*mm*. Ophthalmoscope: O. D., interior normal in appearance; O. S., simple atrophy of nerve. Fields: O. D., normal for white and red, green could not be recognized; the red appears fainter on the temporal than on the nasal side. No sign of acromegaly or other trophic disturbance.

October 10th. Wassermann, negative. Nasal examination by Dr. S. L. Craig revealed a badly deflected septum. Probe could not be inserted into right sphenoidal sinus. Through left side, probe appeared to go into the cranial cavity without resistance.

On October 30th, Dr. Craig passed a cotton-tipped applicator and probe into the cranial cavity through the left side of the

nose, preliminary to X-ray exposure. About half an ounce of viscid, brownish fluid dripped from the probe. Laboratory examination of the fluid showed cholesterin crystals and pus cells. X-ray plates showed probe and applicator in cranial cavity.

Dr. A. F. Holding reported from X-ray examinations: "Destruction of the bones of the internal walls of both orbits, very greatly enlarging and changing the outlines of the sphenoidal fissures; sella turcica obliterated, and posterior wall of sphenoid sinus destroyed; left frontal sinus and maxillary antrum show increased density; deviated septum and bulging outward of internal and anterior border of left orbit. The appearance suggests a tumor of the hypophysis with wide extensions. However, there is nothing in the plate to absolutely determine where the tumor is primarily."

Following withdrawal of the fluid on November 4th, vision in the right eye had improved to $\frac{20}{70}$, and the exophthalmometer readings were: O. D., 18*mm*; O. S., 20*mm*.

On November 12th, Dr. Craig removed the middle turbinate on the left side and thus brought into view an area of exposed dura.

November 13th. Vision: O. D., $\frac{20}{70}$; O. S., movements of objects. Exophthalmos: O.D., 17*mm*; O.S., 19*mm*.

Dr. M. J. SCHOENBERG presented a case of **zonular cataract at the posterior pole.** The patient was a girl, twelve years of age. The zonular cataract showed two concentric opaque rings with transparent zones around them and somewhat anteriorly one to the other, so that the entire appearance was that of a cup. Vision: $\frac{20}{70}$ in this eye; $\frac{20}{30}$ in the right eye. The mother says that the girl had a number of convulsions from the age of two to the age of ten. There was nothing else in the history of patient of interest regarding present condition. Examination of the literature revealed the fact that such cases of zonular cataract—shifted backward in the region of the posterior pole—are of very rare occurrence.

Dr. SCHOENBERG also showed a patient with **foreign body in globe.** This case had already been shown at a previous meeting of the Section. He extracted a piece of non-magnetic metal from the anterior chamber of the left eye a few weeks ago, and the iridocyclitis preceding the extraction is rapidly subsiding.

Vision improved from perception of light to $\frac{20}{200}$. The foreign body had been in the eye for twelve years.

Dr. E. S. THOMSON presented a case of **zonular opacity of the cornea.** The patient, a child of twelve years, gives no family history of importance. The von Pirquet reaction is negative; Wassermann, positive. There are extensive posterior synechiæ. It is apparent, therefore, that the iritis has either been of a very quiet type or that the period of the inflammation antedated birth. The opacities on the corneæ have been increasing, according to the statement of the patient's sister. They are quite characteristic of the zonular opacity which Fuchs describes. These opacities consist of calcareous spots of degeneration and occur, usually, in eyes which have suffered from severe iridocyclitis or glaucoma. Fuchs states that they may be scraped off if they interfere with vision. It is unusual to see a case of this type in so young a child.

Discussion. Dr. SCHOENBERG said that he had seen a case, similar to Dr. Thomson's, two years ago, where the entire cornea was involved. Some of the opacity was scraped off, but the culture was negative.

Dr. MAY asked if carbonate of soda had been tried in this case.

Dr. THOMSON replied in the negative.

Dr. H. H. TYSON presented two cases of **retraction of globe upon abduction.** CASE I. A. P., boy, age 6 years; compound hyperopic astigmatism. The child had squinted since birth; no traumatism. He was unable to abduct the left eye beyond the median line; upon adduction, the left eye recedes into the orbit 1*mm*; palpebral fissure narrows and lids fall inward.

CASE II. R. K. girl, age 9 years. The motility of the eyes has been defective since birth. No history of traumatism; hypermetropic. Motility outward in left eye limited to median line. Upon adduction, left eye recedes in orbit 2*mm* and turns slightly upward at times. Lids fall inward; palpebral fissure narrows. Right eye in adduction develops horizontal nystagmoid movements. Patient complains of diplopia (homonymous) for a year and a half.

These cases may be mistaken for paralytic squints unless carefully examined. Heuck, in 1879, was one of the first to report such cases. Since that time, about seventy cases have

found their way into the literature. In the majority of cases reported, in addition to the squint there is an absence of abduction (in a few cases, of adduction). Adduction was only limited, and often there was permanent exophthalmos. The retraction movements occurred upon attempting to move eyes inward. These cases may be accounted for by the insertion of the recti muscles, usually internus being very far back (in one case, *20mm*, from cornea), or by fixation of globe on the temporal side, due to external rectus being replaced by a rigid fibrous band, with few or no muscular elements. The latter is the more common. Both conditions have been found—partly experimentally, and partly through operation. These cases are of the fibrous-band variety.

Dr. H. H. TYSON presented a case of **methyl-alcohol amblyopia.** H. S., *22* years of age, a patient at the Knapp Memorial Eye Hospital. He gave a history which was confused and contradictory, but was about as follows: Three months ago, on a Saturday afternoon, he drank some home-made cherry schnapps, made from alcohol purchased from a grocer, in which was placed some chemical. On the following Monday morning, his vision was blurred and indistinct. Two months later, he had some more of the schnapps, and about two weeks after that, another drink of it. *Examination October 27th.* Right eye: perception of movements of hand in extreme inferior part of field. Left eye: $\frac{20}{200}$, absolute central scotoma, with contraction of color field, especially above—green to 10°; blue, 25°; white, 35°, except superior arc to 10°. Fundi show extremely white disks, white lines along retinal vessels (indicating previous perivasculitis) with occasional obliteration of small branch vessels; main arteries and veins not changed much in size—altogether constituting a typical picture of methyl-alcohol amblyopia.

Dr. W. B. WEIDLER presented a patient with **interstitial keratitis.** P. P., age 11; the trouble began six months ago. When first seen, there was marked blepharitis, photophobia, lacrimation, pericorneal injection, and well advanced interstitial keratitis. Wassermann was positive, and well marked Hutchinson's teeth. Von Pirquet, very positive, and later a subcutaneous injection of old tuberculin gave general reaction with a rise of temperature to 104°. There is an old sinus in the

left hip that has been present for years. No discharge at present time. The case has been treated with "bacillary emulsions" over a period of three months, with improvement of ocular and general condition. At present, patient is getting "bacillary emulsions" and mercurial inunctions.

Discussion: Dr. H. H. TYSON advocated the combined anti-syphilitic treatment with tuberculin injections. He related the history of one of his own cases—a little negro boy who had a very intense interstitial keratitis which did not improve much under either tuberculin injections or Hg. with K. I., when used separately, but which improved rapidly, with an ultimate good result, when both treatments were given simultaneously.

Dr. T. H. CURTAIN presented a patient where **treph ning had been done for detachment of retina.** Patient, male, aged 21. Wassermann re ction, negative; von Pirquet, negative. On the morning of September 22, 1914, he noticed someth ng wrong with the sight of the left eye, but did not seek medical attention until September 26th, when he visited the New York Eye and Ear Hospital.

When first seen, the vision was: O. D., $\frac{20}{40}$; O. S., limited to hand movements in the lower and outer fields. The ophthalmoscopic examination of the left eye showed a large detachment of the lower and outer part of the retina. The retina was bluish white, thrown into folds, with the loss of the light reflex of the vessels. This area extended well up near the macular region, but the disk was still visible. Outside of a few floating vitreous opacities, the fundus was otherwise normal. There was no history of any trauma whatever.

The patient was sent to the Manhattan Eye and Ear Hospital, which he entered the following day, October 2d. He was given the usual non-operative treatment for detached retina, consisting of the recumbent position, the instillation of ½% atropin twice daily, with a mild pressure bandage over the affected eye. Pilocarpin sweats every other day. This treatment was continued—he being kept upon his back—until October 12th, no improvement being apparent, either subjectively or objectively. He was then taken to the operating room and a scleral button—*2mm* in diameter—removed from under a conjunctival flap over the site of the detachment and

as far back as possible between the inferior and external rectus muscles. The choroid and retina were not punctured at this time, and the conjunctival flap was united by two sutures of silk. A moderate pressure bandage was reapplied, the patient returned to bed, and the atropin drops still continued. He remained in the recumbent position until October 22d. The eye showed a moderate amount of reaction, and by October 22d it was fairly white. He was again taken to the operating room. A medium-sized aspirating syringe was pushed through the scleral opening made by the trephine, and clear white fluid was aspirated. Subsequently, this was found to resemble serous fluids in general.

The fundus of the eye was immediately examined. The retina was seen to have fallen back into place. The patient was returned to bed and kept there until November 4th. No detachment has taken place since that time. The vision of this eye has continuously improved, from the perception of the hand movements in the lower and outer fields to $\frac{20}{40}$ minus, with a minus 1 cylinder axis 180°. Externally, the eye shows a localized chemosis around the scleral opening. The fields of both eyes show a concentric contraction, but the fields of the left eye are equal to that of the right.

Dr. MARPLE congratulated Dr. Curtain on the result in this case, and expressed the hope that it would prove to be permanent.

Dr. E. M. ALGER presented for **diagnosis** a patient with **hysterical amblyopia, spasm, and diplopia.** She was a girl of 16 and came under observation complaining of poor vision, headaches, and seeing double. Examination showed the media clear and the fundi normal. Vision, $\frac{20}{100}$, was improved by -5 to $\frac{20}{50}$. Retinoscopy and ophthalmoscopy showed an apparent but variable myopia of several diopters. Under atropin, the myopia disappears and the refraction is a low hyperopia by all tests, and the vision $\frac{20}{30}$. Motility by Maddox rod and similar tests; she has an esophoria of less than 5°, but during ophthalmoscopy and other tests develops an extreme convergence, both eyes converging instead of one fixing and the other converging, as though she was looking at an imaginary object a few inches from the root of the nose. Outward rotation of both eyes is less than normal, but the movement does not impress

one as made in good faith. Diplopia directly in front persists after the object of fixation is carried entirely beyond the range of the opposite eye, on either side—in other words, a monocular diplopia. Fields of vision are moderately contracted in each eye, but vary with each test. Field for color was not taken. Almost complete conjunctival anæsthesia; corneal sensibility, much diminished.

No very definite history obtained. Patient is bright, fond of school, does not cry, but has had two attacks of "fainting" in past six months. It seems to be a straight hysterical case. The diagnosis is important, because two ophthalmologists have advised operation on her muscles.

Dr. ALGER also presented a case of **word blindness.** The patient was a man who suffers from arteriosclerosis. Six months ago he had a seizure in the street, which did not render him unconscious but has rendered him unable to read and has apparently affected his mentality slightly. There was no evidence of any paralysis. Media clear and fundi normal in both eyes. Vision, $\frac{20}{30}$ in each, and with presbyopic correction he can see the letters in Jaeger No. 2, singly with either eye. He has a right homonymous hemianopsia, strongly defined and not including either macula. The pupils react normally. Given a card containing some familiar names, his own, for instance, or a common word, he cannot read it, though he can distinguish the individual letters perfectly. When asked to spell the word aloud, he does so readily, and immediately recognizes the word and its meaning. He gets the same effect by spelling the word to himself. This "word blindness" is due to a lesion in the angular convolutions—probably a small hemorrhage.

Dr. MARTIN COHEN reported a case of **simple detachment of the retina in both eyes during pregnancy.** Mrs. H., colored, age 26, was admitted to the Harlem Hospital Maternity Ward on September 22, 1914. She was a primipara, pregnant eight and a half months. Four days before admission, she began to complain of a gradual failure of vision. With the right eye, she can count fingers at one foot; and with the left, she recognizes finger motion at the same distance. In either eye a relative central scotoma was present. There were no other complaints of any kind. The visual fields were similar in both

eyes. They were taken at the bedside with a 5*mm* white square in good illumination. The results were as follows: Temporally, 75°; above, 30°; below, 60°; binasal hemianopsia; tonometric pressure, 15*mm* mercury.

The ophthalmoscopic findings were similar in character in both eyes; disks normal; veins normal in course and caliber; arteries in general slightly contracted; no changes in the macula. A small flame-like hemorrhage was visible at the upper and outer border of the right disk, and another near the superior nasal branch of the left artery. At about two disk diameters from the lower margin of the papilla of both eyes there began a typical detachment of the retina. The retinal vessels over this area appeared dark and protruded about 2*mm*. At this early stage, the detachment presented a cauliflower-like outline.

The patient appeared to be a well nourished woman with thoracic organs normal. The ankles and feet had been œdematous for the past three weeks. Photopsia and headaches were absent, and there were no gastro-enteric symptoms. Subjectively, she complained only of the deterioration of vision. The blood pressure was 170*mm* mercury. The urine was straw-colored, cloudy, and coagulated completely on boiling. No sugar. Specific gravity, 1.018. The microscope showed a few hyaline casts. The urea excretion varied daily, from 13.9*gm* in twenty-four hours on the day of admission, to 16.7 at the time of discharge.

The treatment consisted of colonic irrigations, milk diet, veratrum viridi, and rest in bed. Labor was induced September 24th, and a living healthy child was delivered. There were no evidences of a change for the better in the eye conditions until September 29th, when the detachment was seen to be less prominent, with upper border horizontal and slightly receded. Patient could now count fingers with both eyes at five feet. The visual fields showed slight concentric contraction except above, where there was a scotoma to the horizontal meridian. There was no relative central scotoma. The hemorrhage in the right eye had been absorbed, while that in the left eye was still present. The abnormal urine findings were less marked, and the blood pressure was down to 160*mm* mercury.

The patient left the hospital against advice on October 3d, and was seen at her home one week later. The detachment was no longer apparent, and the blood-vessels which traversed the area appeared normal and on the same level with the surrounding retinal vessels. The blood clots had been absorbed. The central acuity and visual fields were normal, as were likewise the urinary findings.

The important facts in the case are: (1) The rarity of retinal detachment during pregnancy; (2) the early temporary binasal hemianopsis; (3) the spontaneous reapposition of the retina to the underlying choroid after delivery, also with no apparent tendency to recurrence.

Dr. JEAN had seen one case like this at the Lying-in Hospital.

NEW INSTRUMENTS SHOWN

By Dr. CARL KOLLER: A lacrimal canula which he has used in his office for the last four years.

By D. I. HELLER: A lid retractor to take the place of a speculum.

By Dr. A. T. HERZIG: A lacrimal probe which narrows at the proximal portion.

Paper: Dr. WILBUR B. MARPLE made some interesting remarks about his experiences and observations in Europe during wartime.

REPORT OF THE TRANSACTIONS OF THE SECTION ON OPHTHALMOLOGY OF THE ROYAL SOCIETY OF MEDICINE.

By Mr. C. DEVEREUX MARSHALL, F.R.C.S., London.

A meeting of the Section was held on Wednesday, December 2d, Mr. Priestley Smith, F.R.C.S., President, in the Chair.

Miss Rosa Ford showed a case in which an eyelash pierced the lid border backwards.

Sir Anderson Critchett showed a patient with small optical iridectomies in a case of lamellar cataract. He described the operation, which was initiated by his father fifty years ago, and narrated cases so treated in which the result was very permanent. Mr. W. H. Jessop spoke favorably of the procedure, which he had himself carried out with great success, in adults as well as in children. In one case, operated upon twenty-two years ago, the result was as good to-day as at the time. Dr. Angus MacGillivray (Dundee) said he had done the operation described several times. The results by removal of the lens were not as satisfactory in lamellar as in other forms of cataract.

Mr. Leslie Paton showed a case which he regarded as Mikulicz's disease, and gave his reasons for the view. Col. R. H. Elliot referred to a case of the disease which he published in *The Ophthalmoscope;* that of a Hindu woman æt. 49, in whom the lacrimal glands on both sides bulged like short horns, and the accessory portions of these glands projected into the conjunctival sac. The parotid, sublingual, and submaxillary glands showed fullness. Removal of the lacrimal not only improved the appearance, but was followed by subsidence of the other glands. The tissues removed presented

a close resemblance to the appearance of round-celled sarcomata.

Mr. ROBINSON exhibited a case of **iridocyclitis,** and Mr. EASON one of **bilateral temporal hemianopia,** to illustrate the importance of taking the fields of vision in every case of optic atrophy. The patient, though he had seen many ophthalmic surgeons, became so blind that he had to be led about. His fields had not then been tested. He could make out moving objects and lights on the nasal side only. The onset of blindness within six months was unlike the history of the optic atrophy of tabes, and Mr. Eason thought he might have pituitary tumor. Within a month of taking thyroid he got remarkable improvement of vision. He still took the extract, for if he went long without it, he noticed a relapse. The sella turcica was somewhat enlarged.

Mr. HOLMES SPICER showed a case with angioid streaks.

THE LATE CAPTAIN ANGUS MACNAB.

The President made sympathetic reference to the death, on the battlefield, of Mr. Angus Macnab, an active member of the Section, and proposed a resolution of sympathy with his family which was passed.

The Section then proceeded to the discussion of the subject, "The Necessity for an Exact Definition of Blindness."

Mr. HAROLD B. GRIMSDALE, in opening the debate, stated that the importance of defining, if possible, the condition of blindness had long exercised the minds of those concerned in the teaching and maintenance of the blind, and the recent awakening of public interest in the question made it all the more urgent to clear away doubt. On the recently appointed Committee on the subject, he was the sole representative of ophthalmic surgery; he had therefore invited this Section of the Royal Society of Medicine to try and arrive at something like unanimity on the question. Many members of the profession whom he had asked, found it impossible to define the status of a blind child otherwise than was done in the Act of 1893, namely, that for educational purposes a child shall be considered blind who is too blind to read the ordinary school books.

Yet all children who did not come into this definition were not fit for the ordinary school; for instance subjects of high myopia. It was desirable to have some rule for evaluation, as a guide, in each case. Many factors must be taken into account; and these concerned both the state of the patient and his employment. Both central acuity and the state of the peripheral vision must be considered, as well as the relative value of the two eyes, and the presence or absence of binocular vision. For certain employments a greater acuity was needed than for others. Thcse having no perception of light were but a small proportion of those ranked among the blind, while among children the proportion was still smaller. Among adults the blindness from optic nerve atrophy and glaucoma led to a preponderance over children. In a blind school, of 68 children, 8 had no perception of light. In Boston, Mass., of 2021 eye patients, .6% were totally blind, 7.7% "practically blind," with a vision less than $\frac{6}{60}$ of normal. These figures were not a guide, because totally blind persons would not seek relief. The blind persons in the United Kingdom number about 27,000 according to the Census, but this could not be accurate. The ratio of the totally blind to the economically blind was about 1 to 9. The causes of economic blindness in children differed considerably from those in the adult. In the former, the chief trouble was loss of central acuity from corneal conditions; while in adults disease of the optic nerve with contraction of the visual field operated chiefly. There was evident a tendency to make the standard of vision too high, and thus throw a large number of children into the "blind" class. One reason was that a child with bad sight demanded more individual attention from his teachers than the others, and so constituted a drag on the class as a whole. This was a stimulus to put such child into a special school. This might ensure his education being better looked after for the time, but once labeled "blind" he was liable to be drafted into a blind workshop. The coeducation of the blind and the seeing was one of the most interesting experiments which had been conducted: the blind child was first started in a special school until he had mastered the elements of Braille writing, and reading; then he took his place among sighted children in the universal school, and often competed successfully with normal children.

The capacity to read separate letters was a very different matter from being able to read words; from experiments he found that the "near" acuity as measured by reading words was often more than twice the distant acuity measured on single letters. Often so-called blind children tried to read Braille by sight in preference to by touch. He contended that between the "blind" school and the normal school there should be a third school for children who had such visual defect that they could not be taught by the aid of the blackboard. His suggestion was that a distant acuity of $\frac{6}{60}$ should be taken as the highest limit of vision for a blind school child. Those whose vision was better was $\frac{6}{24}$, unless otherwise recommended by a medical man, he would send to an ordinary school. All special schools should be inspected at least once a year, and the vision of each child tested and recorded. Among the blind there would always be two classes: those who could not see at all or scarcely so, and those who could distinguish large objects, and so could guide themselves by their eyes in unfamiliar surroundings. Given a good field, an acuity of well below $\frac{3}{60}$ enabled a man to move freely in the outside world; hence he regarded $\frac{6}{60}$ as too high a standard below which a man should be regarded as practically blind. Mr. Grimsdale then dealt with the question in relation to various trades, and in conclusion suggested the appointment of a sub-committee to deal with the question in all its bearings. It was undesirable that a Bill on the subject should pass through Parliament without any reference to the opinion of that Section of the Royal Society of Medicine, for in that case most difficult questions would be left to the decision of absolutely unqualified amateurs.

Mr. ROCHCLIFFE said that for many years he had advocated some definition of blindness. The Local Government Board defined blindness as "Too blind, in the opinion of the Local Government Board, to perform work for which eyesight is ordinarily required." Others expressed it as "Blind for the practical purposes of life." During thirty years he had examined and admitted into a blind school large numbers, and his decisions had not been questioned. He divided cases into (a) blind; (b) partially blind. The latter were those who were able to differentiate fingers at a greater distance than three feet. There should be a clear distinction drawn between capa-

city for ordinary school education, and for technical education. A good broad distinction was: those who could count fingers at three feet, and those who could not. There should be a clear decision as to who should be participants in pensions for the blind.

Dr. ANGUS MACGILLIVRAY (Dundee) said that for industrial purposes so-called blind people could be divided into three classes: (1) totally blind, those who had no perception of light; (2) practically blind, those possessing perception of light but unable to take part in industrial occupations owing to marked impairment of vision; (3) the partially blind, whose defect prevented them obtaining employment in ordinary sighted workshops, their vision yet being such as to disqualify them from entrance to a blind institution. Thirty per cent. of the inmates of blind institutions belonged to the category of partially blind. He discussed the case of children, and the general question in relation to occupations.

Mr. N. BISHOP HARMAN contended that there was only one exact definition of blindness, the dictionary one—"want of sight." But the term was used to include many varieties of partial blindness, and for those that definition was sought. Vision was a complex act: acuity, field, mobility, mentality, and effects of difference of lighting, habit and custom, all took a share in the sensation. It was not possible by any sufficiently simple definition to gather up possible varieties, any one of which might constitute partial blindness of serious order. Any definition must be related to the facts of life, must have reference to the person's capacity for work. If it could be certified that he was incapacitated from engaging in profitable labor by reason of his defect, his was a state of blindness. Any attempt to pass a definition of blindness drawn in professional terms, to operate through the Legislature, was, he contended, doomed to failure, and was liable to be altered out of recognition. The definition in the Elementary Education Act, "inability to read the ordinary school books used by children," was worthy the judgment of Solomon, for it defined blindness in terms of life. He pointed out the parallelism of the case of mental defectives, in which also reference was to life. He advocated a certification of blindness by two independent and duly approved medical men, who should be required to state their opinion,

and the facts upon which that opinion was based; such opinion being subject to the scrutiny of the medical officer of the proper authority.

Mr. RICHARDSON CROSS (Bristol), thought the Legislature was rightly attacking this question. If a child's sight was such that it could not attend the ordinary school, some other arrangement for its education must be made. There were blind schools for those nearly blind, and intermediary schools for myopes. Anything brought forward to deal with the infirmity in adults would not influence the good work being done for the children. Ophthalmic surgeons should agree among themselves as to a proper definition of a blind person. He thought it would be unsound to take the view that the layman was unable to judge on this matter. He thought the Registrar would accept two classes. One would embrace those who had no more than perception of light; the other either Snellen's types, or finger-counting, the latter for preference. Anyone who could not count fingers at a greater distance than a yard should be regarded as practically blind. In order to be practical, he thought that at first there should be some sacrifice of scientific precision; this could perhaps be arrived at later.

Mr. W. T. HOLMES SPICER contended that the persons to decide this question should be expert ophthalmologists, not lay members of a County Council. Any rules arrived at should be for the guidance of expert examiners.

The President pointed out how well qualified this Section was for giving expert advice on such a matter, which was of the first importance.

QUARTERLY REVIEW OF THE PROGRESS OF OPHTHALMOLOGY.

By H. KOELLNER, Berlin; W. KRAUSS, Marburg; R. KÜMMELL, Erlangen; W. LOEHLEIN, Greifswald; H. MEYER, Brandenburg; W. NICOLAI, Berlin; H. PAGENSTECHER, Strassburg; K. WESSELY, Würzburg; and M. WOLFRUM, Leipsic, with the Assistance of Drs. ALLING, New Haven; CALDERARO, Rome; CAUSÉ, Mainz; DANIS, Brussels; GILBERT, Munich; GRÖNHOLM, Helsingfors; V. POPPEN, Petrograd; TREUTLER, Dresden; and VISSER, Amsterdam.

Edited by MATTHIAS LANCKTON FOSTER, M.D., New Rochelle, N. Y.

SECOND QUARTER, 1914 (*Continued*).

VII.—THE SENSE OF SIGHT.

60. DELL' ERBA. **Contribution to the physiology of the visual function.** *Annali di Ottalm.*, v.–vi., 1913.

61. FISHER, J. HERBERT. **Observation on the learning of vision, after a successful operation at the age of six years, in a congenitally blind patient.** *Ophthalmic Review*, June, 1914, p. 161.

62. GILDENMEISTER. **Some analogies between optical effects and electrical stimuli.** *Zeitsch. f. Sinnesphysiol.*, xlviii., p. 252.

DELL' ERBA (60, **Contribution to the physiology of the visual function**) was obliged to have his left eye enucleated in consequence of an accident. The vision of his right eye remained perfect for two years, then came a loss of appreciation of details and of distance. This condition improved gradually until it was almost normal again at the end of a year. He thinks that perhaps there is a special stereoscopic center which serves to blend the retinal images into one, and through this blending produces the appreciation of detail, distance, and localization in space. This theory explains how a person who closes one eye enjoys the benefits of binocular vision, as the

center continues to functionate under the influence of only one retina through association with former perceptions. After the enucleation of one eye this center atrophies in consequence of lack of function and extension of the process of degeneration. In the case of the writer this happened at the end of two years. It is possible that a one-eyed person, in whom this center has become atrophic, regains perception of bodies and space through a new education and habit. Dell' Erba is inclined to locate the supposed stereoscopic center in the internal geniculate ganglion.

CALDERARO.

GILDENMEISTER (62, **Some analogies between optical effects and electrical stimuli**) says that the very weakest light stimuli appear to die out shortly after the flash, not differing in this respect in their action from the electrical current, which also is ineffective after the closure. Both are transient stimuli. On the other hand strong electrical currents stimulate during their whole continuance, and the same is true of ordinary light stimuli.

FISHER (61, **Observation on the learning of vision**) reports a case in which he describes the attempts to make use of the newly acquired vision by a child of six years, after a successful operation. The case is very similar to the one reported by Uhthoff, but without the difficulties in orientation and the tubular field, which were present at first in Uhthoff's case.

CURRAN.

VIII.—ACCOMMODATION AND REFRACTION.

63. BOURDEAUX. **Treatment of extreme myopia.** *Ann. d'oculistique*, cli., p. 470.

64. MARQUEZ, M. **Biastigmatism and its treatment with double cylindrics at oblique axes.** *La clinique ophtalm.*, xx., p. 221.

65. MEYERHOF, M. **Study of myopia as a hereditary, racial disease among the Egyptians.** *Annales d'oculistique*, cli., p. 257.

MARQUEZ (64, **Biastigmatism and its treatment**) believes that there are more cases of extracorneal astigmatism than is generally admitted. This refractive error, wrongly called lenticular astigmatism, may or may not have the same direction as that of the corneal astigmatism. It is just such cases in which the principal meridians of the corneal astigma-

tism do not coincide with those of the lenticular or rather of the extracorneal astigmatism, that the author wishes to call "biastigmatic." The diagnosis is made first by correcting the corneal astigmatism according to the findings with the ophthalmometer, then by the subjective method—namely, adding the cylinder on an axis which succeeds in making the lines on the astigmatic dial of equal brightness. The correction of biastigmatism consists in combining cylinders with their axes inclined or cylindrical torics or bitorics. The author gives a table of formulas by the aid of which a combination of two cylindrics, axis inclined, may be transformed in spherocylindrics.

SCHOENBERG.

MEYERHOF (65, **Study of myopia in Egypt**) found 18% among 7617 patients to be myopes. The male is more frequently affected than the female sex. The radius of corneal curvature was 7.41*mm* in patients of less than 10 D. and 7.30*mm* in those of more than 10 D. myopia. The interpupillary distance, contrary to the assertion of some authors, was found to be smaller in myopes than in hypermetropes and emmetropes. Astigmatism, measured with the ophthalmometer, was found present in 40% of all the myopes. The author attributes the high percentage of myopia among Egyptians to an inborn weakness of the sclera, peculiar to the race. It is surprising to learn that myopia is very rare among Nubians and Soudanese, living in such a close neighborhood.

SCHOENBERG.

BOURDEAUX (63, **Treatment of extreme myopia**) recommends total or subtotal correction under atropine, prolonged atropinization of the eyes, the use of a pressure bandage at night, and frequently during the day, and subconjunctival injections of 20% salt solution with cocaine and dionin. General treatment is not neglected. He reports some excellent results.

CAUSÉ.

IX.—THE MOTOR APPARATUS OF THE EYE.

66. AGRICOLA. **Indications for, and action of, advancement.** *Ninth Meeting of the Ophthalmological Society of Lower Saxony.*

67. BIKELES. **Explanation of a phenomenon of the orbicularis oculi.** *Zentralblatt f. Physiologie*, xxvii., p. 1267.

68. BIKELES and ZBYSZEWSKI. **An action of the orbicularis oculi after irritation of the cerebrum.** *Ibid.*, p. 1265.

69. LEVA. **Caloric nystagmus in comatose conditions.** *Thirty-ninth Meeting of the Neurologists and Alienists of Southwest Germany*, May 23d.

70. OVIO. **Movements of the eye and retinal images in reading.** *Arch. di Ottalm.*, 1914, p. 29.

71. ROSENFELD. **Vestibular nystagmus of the head and of the facialis in pseudobulbar paralysis.** *Arch. f. Psychol. u. Nervenkrankheiten*, liii., p. 1130.

72. SCHMIDT. **Monolateral nystagmus.** *Diss.*, Rostock.

The movements of the eye and the production of images form, according to OVIO (70, **Movements of the eye and retinal images in reading**), two important factors of the mechanism of the eye in reading. These movements are lateral convergence and accommodation movements, which cause displacements of 25° to 30°. They are therefore enormous and capable of producing weariness, as is evident when one thinks that the visual field has an extent of 80° in each meridian, and that movements that exceed a third of the potentiality of an organ always cause weariness. The author does not believe that the slight movements of accommodation which take place during reading are a cause of myopia, because they represent a physiological function, and the varying tension is less harmful than the constant. As the object and the picture correspond to sections of a parallel, they have similar forms, but as soon as the object is sought, the sections of the cone are no longer parallel and the image presents a different form. Tilting of the object reduces the picture in proportion to its nearness to the eye, so that when one reads under such conditions he uses not a quarter nor a third of his visual acuity, but a half or more. In this way we exceed the limits within which a work can be performed without weariness.

CALDERARO.

Patients with facial paresis are often unable to close the eye on the affected side although the closure of both eyes is complete and prompt. Hitherto it has been thought that this phenomenon was because of a double localization of the closure of the eye in the central organ. BIKELES (67, **Explanation of a phenomenon of the orbicularis oculi**) presents the explanation that the bilateral closure of the eyes requires less energy of innervation than the closure of either one, and that there-

fore when there is a mild degree of paresis of the orbicularis the innervation may not suffice to close the one eye, although sufficient to close both.

BIKELES and ZBYSZEWSKI (68, **Action of the orbicularis after cerebral irritation**) make some statements concerning the action of the orbicularis after irritation of the cerebrum. Irritation of the cortex usually produces twitching of the orbicularis on the contralateral side, in some cases on the same side. A notable point is that after the cessation of the irritation twitchings appeared in both orbiculares. The authors maintain correctly that this cannot be due to a double innervation, but that only the ordinary common action of the two centers is the cause of the twitchings of the unirritated orbicularis in these cases.

LEVA (69, **Caloric nystagmus in comatose conditions**) describes the caloric investigation of the vestibule which he finds particularly fitted for the examination of unconscious patients. He pictures the different kinds of caloric reaction in coma, and distinguishes four stages of coma according to the type of reaction. Type 1: The reaction of normal consciousness; the eyeballs make strong nystagmic movements toward the opposite side. Type 2: The reaction of brightening consciousness; moderate nystagmus toward the opposite side, with fluctuating movements of deviation toward the irrigated ear. Type 3: The reaction of deep coma; the eyeballs turn toward the side of the irrigation and remain quiet for a long time, fixed deviation toward the same side. Type 4: The reaction of terminal coma; the eyeballs remain immovable in their original position, there is no reaction at all. The author has calorized a number of patients in coma and noted particularly whether it was possible to determine from the reaction which of the two hemispheres was the more affected. I. In two patients he found the reaction to be of type 1; there was no difference between the right and the left as regards the caloric reaction, whence he concludes both hemispheres to be equally affected. II. Three other cases presented general symptoms of tumor of the brain; two showed no localizing symptoms, the third had signs of a spastic hemiparesis. In all three the calorization of the side proved later by autopsy to be affected produced type 2, while on the other side it gave

type 1. III. In a sixth case which came under observation in deep coma and furnished no localizing symptoms either in his history or in his clinical condition, a cerebral tumor was suspected, and autopsy revealed a tumor of the hypophysis, calorization of the side in which the tumor had proliferated most gave no reaction, type 4, while on the other the reaction was that of type 2. Observations II. and III. therefore go to show that the caloric reaction more nearly approaches the type of terminal coma on the side corresponding to the more diseased hemisphere than on the other. IV. An atypical reaction appeared in a seventh case. Calorization on each side excited none of the four mentioned types, but an irregular oscillation in which a quick and a slow phase, that of nystagmus, could not be perceived. Autopsy revealed multiple tumors in both hemispheres. Leva concludes from these observations that caloric nystagmus shows a distinct difference between the right and the left in cases in which lesions that contract the space within one half of the skull have been proven *post mortem*. The vestibular apparatus has its excitability much more greatly disturbed on that side than on the other. When lesions are present on both sides there is no difference in this excitability. A conclusion can be drawn from this variance in the vestibular reaction with regard to the side on which there is a space-contracting lesion, and this helps to the location of the lesion. This may be of special diagnostic importance when the lesion is situated in such regions that localizing symptoms are not produced.

SCHMIDT (72, **Monolateral nystagmus**) adds a new case to those of this condition heretofore reported. He divides the cases into four groups: (1) those in which there is or has been a disease of the central nervous system; (2) those associated with strabismus; (3) those in which the nystagmic eye is amblyopic without strabismus; (4) those in which it is associated with movements of the head. Finally there remain six cases not included in these four groups, such as experimental nystagmus and after traumatism.

ROSENFELD (71, **Vestibular nystagmus of the head and facialis in pseudobulbar paralysis**) found an unusual symptom by vestibular stimulation in a man 66 years old with pseudobulbar paralysis. Pareses and contractures with increased

reflexes, bulbar disturbance of speech, loss of voice, and dementia had occurred in the course of the disease. Irrigation of the ear with cold water excited, after a short period of latency, marked nystagmus toward the opposite side and at the same time very lively twitchings of the head in the same direction, with an amplitude of at least 45°. This nystagmus of the head lasted some half a minute longer than the irrigation, that of the eye longer still. Irrigation of the left ear excited rhythmic twitchings in the right facialis. This facial symptom was absent in rotation nystagmus, and only a lively nystagmus of the eyes was caused by galvanism. He believes that the supranuclear foci had effected a separation of the bulbar centers from the cerebrum, so that the excitability of the former was increased and able to express itself by a reaction in groups of muscles that otherwise are not affected by stimulation of the vestibularis.

AGRICOLA (66, **Indications for, and action of, advancement**) says that one should never try to correct more than 15° of strabismus convergens by this operation alone. He recommends a graduated tenotomy associated with the advancement. When possible he tries to obtain the effect desired by a single or a double advancement. When one eye is highly amblyopic and there is a considerable squint one must add either a graduated or a complete tenotomy. He likewise employs a single or a double advancement in divergent strabismus; the former will usually suffice when there is a high degree of amblyopia. In alternating strabismus, even of slight degree, a double advancement is usually necessary, sometimes together with a tenotomy. Likewise in periodic divergent strabismus a double advancement is often necessary.

X.—LIDS.

73. GIBSON, CHARLES L. **Blepharoplasty by a pre-grafted flap.** *Annals of Surgery*, June, 1914.

74. KRUSIUS, FR. **The implantation of living hairs to form eyelashes.** *Deutsche med. Wochenschrift*, p. 958.

75. LOEWENSTEIN, A. **On chalazion and the inflammatory lid tumor.** *Archiv f. Ophthalmologie*, lxxxvii., 3, p. 391.

76. MAHER, W. ODILLO. **An operation for trichiasis.** *Ophthalmoscope*, April, 1914.

77. MAWAS, F. **Researches concerning the histology and histochemistry of xanthelasma.** *Annales d'oculistique*, cli., p. 437.

78. NOGIER. **Treatment of an epithelioma of the nose with radium.** *La clinique ophtalm.*, xx., p. 291.

79. VAN DUYSE, G. M., JR. **Pavement epithelium, adenomatoid carcinoma of the Meibomian gland.** *Arch. d'ophtalm.*, xxxiv., p. 355.

80. WILDER, W. W. **Sporotrichosis of the eye.** *Jour. A. M. A.*, April 11.

LOEWENSTEIN (75, **Chalazion and inflammatory lid tumor**) reports the anatomical findings in twenty-eight cases of chalazion and attempts to explain the chalazion as an anaphylactic inflammation. He distinguishes two groups of chalazia. The first, corresponding to the regular, well defined nodule with soft contents, consists of enormous masses of plasmatocytes which are arranged in numerous infiltrates, frequently showing a regular concentric arrangement. In the other form, dense, newly formed fibrous tissue prevails. Clinically this form is characterized by the multiplicity of the chalazia and their tendency to relapse. Caverns are found frequently in the center of the nodules; their origin is doubtful. He has never found tubercle bacilli, although giant cells were frequent. In the experimental part, Loewenstein describes the anatomical changes that he has produced in the lids of rabbits by single, and by repeated injections of different substances. None of them reminded him of a chalazion, and the anaphylactic origin of the latter remains the same as heretofore, mere hypothesis without any solid basis.

SCHIRMER.

MAWAS (77, **Histology and histochemistry of xanthelasma**) has carefully examined pieces of skin excised from areas of lid with xanthelasma from twenty patients and concludes that the xanthelasmic cells have a glandular function and secret lipoids to which is due the yellow color of the tissues. Three plates illustrate the paper.

SCHOENBERG.

VAN DUYSE (79, **Carcinoma of the Meibomian gland**) describes in detail the histological findings in an atypical, mixed, epithelial tumor of the Meibomian gland found in a patient 60 years old. The prominent feature in the histological picture of the intratarsal tumor was its formation of pavement and

glandular epithelium, which had developed at the cost of the former. The origin of the growth is to be considered as an indirect, embryonal metaplasia.

CAUSÉ.

NOGIER (78, **Treatment of an epithelioma of the nose with radium**) reports a case in which a fairly large epithelioma of the left side of the nose of a man 80 years old was treated successfully with radium. The scar was perfectly firm within a month and the epithelioma was cured. Nogier emphasizes the point that results may be obtained by radium treatment that cannot always be secured with the X-rays.

CAUSÉ.

WILDER'S (80, **Sporotrichosis of the eye**) case was that of a student who infected his eye with sporothrix and developed pain, swelling of the lids, and hypertrophy of the conjunctiva of both eyes. There were also present on the conjunctiva several elevated yellow spots. There were constitutional symptoms, leucocytosis, and enlarged preauricular glands. Sporothrix was grown in culture tubes and spores were found in the scrapings. It was two months before the signs disappeared. Sixteen cases of sporotrichosis of the eye have been reported.

ALLING.

In GIBSON'S (73, **Blepharoplasty by a pre-grafted flap**) first case he employed the Dieffenbach method as a basis for his procedure; in his second and third the Fricke or Celsus method. The first step in the operation consists in making an incision from the outer canthus upward and outward. The lower edge of the incision is undermined so as to form a pocket large enough to contain a flap of skin which is to form the posterior surface of the new lid. A single skin graft is then tucked into the pocket, so that the subcutaneous surfaces are in apposition, and allowed to heal. Ten days later the growth at the outer half of the lid is removed by a quadrangular incision. An incision is now made parallel to the original incision and a sliding flap, with the epithelial lining, is drawn down and sutured into position, covering the defect.

GROUT.

ODILLO MAHER (76, **An operation for trichiasis**). This operation republished from 1897 consists of dividing the

"cartilage" from the under surface of the lid from end to end at about *3mm* from the free edge, dissecting so as to allow the cut to spread, and transplanting, from the mucous membrane of the lip, a strip about *3½mm* wide and the full length of the incision. This is fixed in place with three silk sutures, with knots *2cm* from ends, which are brought through the skin from the under surface. These are left in for thirty-six hours and then removed. The object in having the knots from the ends is to facilitate removal of the sutures. He has used the operation in some hundreds of cases during the last fifteen years with good results.

CURRAN.

KRUSIUS (74, **Implantation of living hairs to form eyelashes**) gives a new procedure for this purpose. It is best to take the hairs from the patient himself, from the eyebrows, or elsewhere, whence they are removed together with their roots and follicles. Each is then placed in a hollow needle which is introduced *2* or *3cm* from the margin of the lid, passed between the skin and tarsus to the margin of the lid and brought out in the row of lashes. The hair is then drawn out a proper distance by means of forceps. Not more than twenty hairs should be implanted at a single sitting. The cosmetic effect is said to be good and the operation to be slight.

XI.—LACRIMAL ORGANS.

81. BRIDE, L. MILNES. **A case of dacryops.** *Ophthalmic Review*, April, p. 99.

82. CASALINO. **Surgical treatment of catarrhal, chronic, or recurrent dacryocystitis of a phlegmonous character.** *Arch. di Ottalm.*, Sept., 1913.

83. HASLINGER, E. **Complex connective-tissue tumor of the lacrimal gland.** *Archiv f. Ophthalmologie*, lxxxviii., p. 28.

84. MAYER, O. **Nasal opening of the tear sac.** *Zeitschrift f. Augenheil.*, xxxi., p. 544.

BRIDE (81, **Dacryops**) reports a case of dacryops in a child one year and five months old. The cyst was between the left upper lid and the globe and was about as large as a pigeon's egg. It was filled with fluid containing a flocculent precipitate.

CURRAN.

Gallenga performs almost exclusively in the clinic at Parma extirpation of the sac in chronic dacryocystitis and cauterization of the sac in phlegmonous dacryocystitis. Since 1907, says

CASALINO (82, **Surgical treatment of dacryocystitis**) there have been 175 extirpations of the sac with perfect healing; only three recurrences have occurred. If one wishes to remove the internal part of the nasal canal after extirpation of the sac, he may use the bayonet knife of Cirincione, or curette it away with a sharp spoon. The margins of the wound are not sutured.

CALDERARO.

MAYER (84, **Nasal opening of the tear sac**) has employed this method in twelve cases, with eleven good results. In one a new occlusion was formed by the growth of a synechia with the greatly deviated septum. Such deviations should be corrected by a submucous resection previous to the operation. The operation proves good also in ectasia of the sac and abscess in its region. West's operation has the advantage over Toti's in the avoidance of a cutaneous scar; it is doubtless more difficult, but is also surer.

HASLINGER (83, **Tumor of the lacrimal gland**) describes a tumor that has no relation histologically to the lacrimal gland, although situated in it. It was composed of an indurated connective-tissue capsule and supporting framework containing myxomatous tissue full of cartilaginous islands. The entire tissue was permeated by complexes of epithelial-like cells that varied extremely in appearance, but were lacking in intercellular bridges.

(*To be continued*)